269

JOURNAL OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS

THIRD SERIES

VOL. 43. No. 6 — 18 JANUARY 1936

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A

EUSTON STATION AND ITS SURROUNDINGS

The directors of the L.M.S. Railway have appointed the President to be consulting architect for the rebuilding of Euston. This has been described as the most important of the schemes to be carried out by the L.M.S. under the newly granted Government loans for railway development. It will give an opportunity for a return to some of the grandeur conceived by Hardwick as appropriate to one of the chief gateways to London from the North.

Mr. Thomas will work in collaboration with Mr. W. H. Hamlyn [*F.*], the company's architect, and with their engineers.

JOURNAL OF THE ROYAL INSTITUTE *of* BRITISH ARCHITECTS

VOL. 43. 3RD SERIES   18 JANUARY 1936   No. 6

Journal

The Royal Gold Medal Nomination

At the general meeting on Monday the President announced that the Council of the Institute had decided to forward the name of Mr. Charles Henry Holden [*F.*] to His Majesty the King as a suitable recipient of the Royal Gold Medal for 1936. Mr. Holden, as most members of the Institute in this country will know, is, with his partners, the architect of the headquarters of the London Passenger Transport Board, No. 55 Broadway, which received the London Architecture Medal in 1929. His firm have also designed other buildings for the Underground Railways, notably those on the Morden and Cockfosters extensions. In 1931 Mr. Holden was appointed sole architect of the new buildings for London University. He is a Vice-President of the Institute, and a member of the Royal Fine Art Commission.

As an instance of the interest shown in this award, as soon as the B.B.C. heard that the nomination had been announced they telephoned to the R.I.B.A. asking that a member should be found to go, then and there, to speak about the Medal and Mr. Holden in the 9.30 National news. Luckily, Mr. W. H. Ansell was able to go, and was given several minutes in which he could tell the B.B.C.'s audience about the nomination. Every event such as this, which is due chiefly to the strength of the contacts established by the Public Relations Committee, contributes inestimably to the public's sense of what architecture is and what architecture does, and of the part played by the R.I.B.A.

Prizes and Studentships

Last Monday Mr. Pakington gave a lively criticism of the prizes and studentship entries. This, together with the President's Address to Students, which he is to deliver on 27 January, will be published in the next number of the Journal, with all the other matter relevant to the award, the statement of the award, the programmes, illustrations of the prize-winning drawings, and some of the competitors' reports. In past years a number of architectural schools have given orders for extra copies of the special prizes and studentships number of the Journal, so that those students who intend to enter for the prizes next year can have a complete display of the drawings which have been successful. We don't know how far the presentation of photographs of all the prize-winning drawings in the R.I.B.A. Journal succeeds in its role as a china egg in the nest to encourage reluctant birds to turn out bigger and better eggs, but it does fulfil the serious purpose of showing, by the reservation of a complete journal almost, how important are the prizes and studentships in the affairs of the Institute. We shall be pleased if any heads of architectural schools who want to obtain an extra supply of the 8 February Journal would send in their orders as soon as possible.

The Royal Fine Art Commission

The Royal Fine Art Commission recently issued a short report on its work in which the scope of the Commission's activities is clearly re-stated :

> " to enquire into such questions of public amenity or of artistic importance as may be referred to them from time to time by any of our Departments of State, and to report thereon to such Department ; and furthermore, to give advice on similar questions when so requested by public or quasi-public bodies, where it appears to the said Commission that their assistance would be advantageous ; . . ."

Under a Royal Warrant issued in August 1933 the terms of reference of the Commission were extended so that it is now open to the Commission, if they so desire,

> " to call the attention of any of our Departments of State, or of the appropriate public or quasi-public bodies, to any project or development which in the opinion of the said Commission may appear to affect amenities of a national or public character."

The duties of the Commission are purely advisory, but, if they have no power to compel those who seek

their advice to follow it, the extent to which they have had, as it were, repeat orders is testimony enough to the value of the opinions they have expressed.

This is evident from the part of the report which names the bodies which have invited the Commission's advice. First, quite naturally, is the First Commissioner of Works, but advice has also been given to the Minister of Transport, the Overseas Trade Department, the Lord Great Chamberlain, and the Privy Council. There are numerous public and local authorities, Deans and Chapters, and various private individuals acting on behalf of advisory art committees. An interesting analysis is made of the types of work concerned. The Office of Works has sought advice about the design or site of thirteen important public memorials. The Office of Works, seventeen County Councils, and one or two Urban Councils have asked about new bridges, the most important of which are, perhaps, the Thames bridges at Richmond, Hampton Court, Chiswick, and Chelsea. There have been five enquiries about the decoration of public buildings, including the British Museum reading-room and the Royal Gallery of the House of Lords, and questions relating to the design of seventeen important new buildings, as well as questions relating to the preservation of old buildings, H.M.O.W. being the leading enquirer; and eight miscellaneous and town-planning enquiries. The work of the Commission is of the utmost importance. The fact that little is heard of it is the best testimony to the quiet way it sets about its duties and the successful way in which it fulfils them. If the Commission were not wise, discreet and in due measure conciliatory every decision would be a *cause célèbre* and the public while knowing all about the Commission's work would probably have much less cause for congratulation.

While on the subject of the Royal Fine Art Commission we can announce that, on the recommendation of the Secretary of State for Scotland, His Majesty has appointed Mr. James Miller, R.S.A. [*F.*], to be a member of the Royal Fine Art Commission for Scotland.

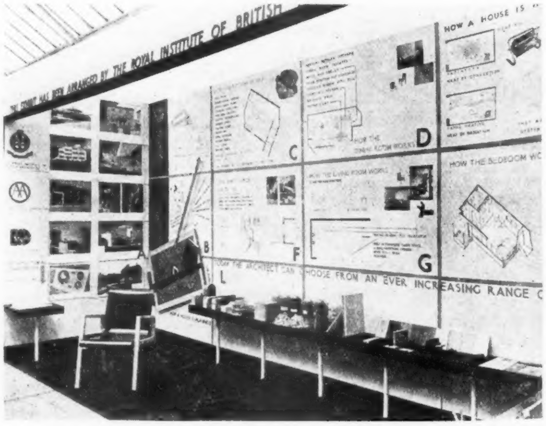
Architecture and Instructional Films

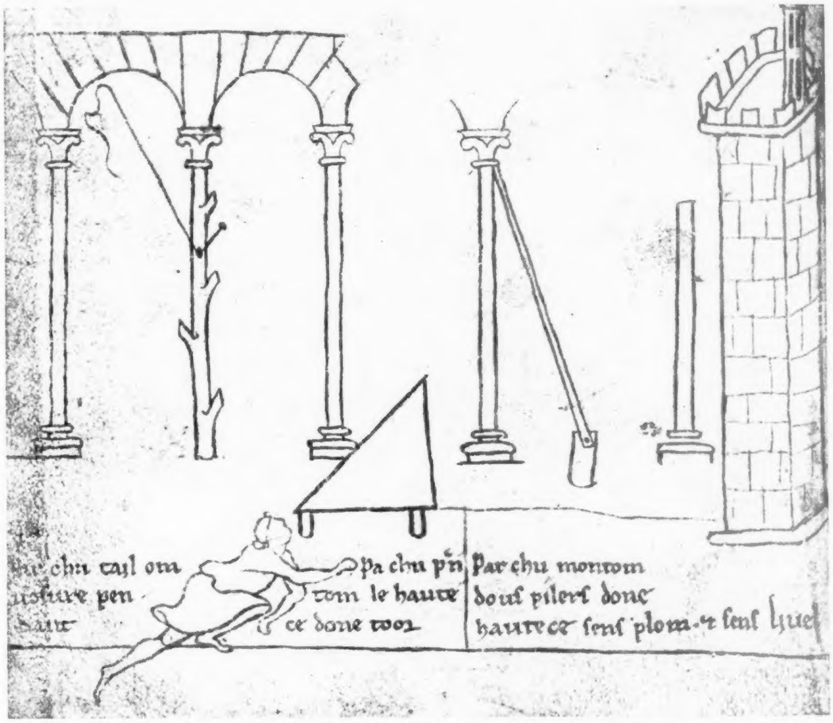
For some time the R.I.B.A. has had a sub-committee of the Public Relations Committee especially concerned with films, and particularly with the promotion of good instructional films, so that the general public can be caught at its hours of ease, when most surely it is receptive to the dramatic realities presented by John Grierson or Paul Rotha and their like. A new organisation has just been started—with the rather too awe-inspiring title Associated Realist Film Producers, Ltd.—to act as a consultant film organisation to Government Departments and other official bodies, to the public services, university and education authorities, etc.—among whom may be included the R.I.B.A. Most of the people who have been prominently connected with the production of publicity and instructional films are associated with A.R.F.P., which has a strong body of consultants representing for the most part non-cinema interests. This body includes on it Professor J. B. S. Haldane and Professor Julian Huxley, Mr. McKnight Kauffer, and Mr. Basil Ward, the chairman of the R.I.B.A. film sub-committee, who will thereby be enabled to keep in close touch with the production side of the film world.

The A.R.F.P. is prepared to give advice to bodies who wish to have films made, to prepare scenarios, to draw up complete production programmes, etc., etc. It is possible that in due time architects will have progress films made of their jobs—there was an excellent Rotha film of the building of the liner *Orion*; that schools will demonstrate structural methods by films—many industrial concerns at present have films of their manufacturing processes which illustrate better than hours of talk how things are made and their proper use. The many good publicity and instructional films that have been made already have hardly touched architecture seriously. There is a whole technique yet to be developed before architectural films can be turned out which will be certain to appeal to a non-architectural audience in an ordinary film programme, but our Public Relations Committee has the whole business "on the spot," and through co-operation, which is assured, with this new organisation progress is certain.

The Schoolboys' Exhibition

The photograph at the foot of the page is of the R.I.B.A., A.A. and Building Centre stand at the Schoolboys' Own Exhibition at the Imperial Institute, which was described in the last number. About sixty entry forms have been sent in for the competition for schoolboys run in connection with the exhibition. This is a venture which has justified itself up to the hilt.





Methods of setting out and measuring from Willar de Honnecourt

THE FUNCTIONAL ASPECT OF THE GOTHIC STYLE

By GERHARD ROSENBERG

The following paper was submitted by the author as a Thesis in the Final Examination, July 1935, and was strongly recommended for publication by the Examiners.

INTRODUCTION—DIVERS ASPECTS OF THE GOTHIC STYLE

The opinions of architectural critics and, in some lesser degree, public opinion of the Gothic style have undergone great changes during the last centuries. When Gothic art was flourishing, few men outside the set of initiated craftsmen and those ecclesiastical and temporal officials who were professionally connected with building work were able to learn anything about the true principles of that method of building. Printing was not practised, and so we have, apparently, no publications before 1475; of the existing books we have tried to compile as complete a list as possible in the Bibliography.* All these books are similar in content to our present-day " Information Book," and thus not conceived to convey an understanding of the principles of the art, but rather an expert advice on its execution.

Gothic buildings, therefore, must have made much the same complex impression on the contemporary mind as they do on our own. Chaucer, in his *House of Fame*, thus renders his impressions :—

> " And eke the hall and everie Boure
> without pieces or joynings
> but many subtill compassings
> as habeuries and pinnacles
> imageries and tabernacles
> I saw, and full else of windowes."

**The Bibliography will be published with part 2 in the next number of the* JOURNAL.

This amazed admiration of monuments that were standing head and shoulders above an age which was none too rich in spectacular achievements made the contemporaries accept the style without question. This attitude was supported by the secrecy that surrounded the "arcanum magistri," the building science of the masters, which was for some time, at least, very rigorously enforced.†

General ignorance of technical principles was the cause of misunderstanding on the part of later architectural writers. These were for the most part ecclesiastics and not connected with the actual building, the result being that they expressed opinions about the Gothic style which were far from doing it justice, or even appreciating its essential facts.

In 1699, Felibien des Avaux sees the origin of the Gothic church interior in the imitation of huts built of branches, thus comparing the columns to tree trunks or bundles of shafts and the ribs of the vaulting to the branches of the trees. He bases his opinion on the fact that the southern peoples who originated this style used to live in such wooden huts. The style was frequently called "Saracen" because it was supposed to have been an imitation of the buildings seen by the Crusaders on their journeys in Saracen countries.‡

This opinion is upheld by Sir Christopher Wren, whose remarks, if not sympathetic, show a more scientific approach to the matter. I will quote some of his views as published in *Parentalia* :—

> "They (the Gothic builders) used the sharp headed arch, which would rise with little centering, required lighter keystones and less buttment, and yet would be strong enough to bear another row of doubled arches, rising from the keystone. By the diversifying of this they erected eminent structures such as the steeples of Vienna, Strasbourg and many others. Glass began to be used in windows and a great part of the outside ornaments of churches consisted in the tracery works of disposing the mullions of the windows for better fixing in of the glass.
>
> "And I must also own that works of the same height and magnificence in the Roman way would be very much more expensive than in the other Gothic manner."

The fashionable scorn of Gothic was the consequence of an artificial state of society in which display of wealth and pleasurable indulgence became the chief animating motives of an art that found its main expression in vast and luxurious dwellings. (Moore.) The radical change in the esteem for Gothic architecture is very strangely expressed in Mr. Evelyn's criticism, which finds Sir Christopher Wren's full support.

> "About 200 years ago," says Wren, "the architects ashamed of the modern barbarity of building began to examine carefully the ruins of old Rome and Italy, to search into the order and proportions and to establish thereby inviolable rules. It is to their labours and industry we owe in a great degree the restoration of architecture. The ingenious Mr. Evelyn makes a general and judicious comparison in his account of architecture :
>
> "Goths, Vandals, and other barbarous nations subverted and demolished them (Greek and Roman art) introducing in their stead a certain fantastical and licentious manner of building, which we have since called modern, or Gothic ; congestions of heavy dark melancholie and monkish piles, without any just proportion, use or beauty, compared with the truly ancient.
>
> "They set up those slender and misshapen pillars, or rather bundles of staves and other incongruous props to support incumbent weights and ponderous arched roofs without entablature.
>
> "For proof of this I dare report myself to any man of judgement, after he has looked awhile upon King Henry VII's Chapel at Westminster, gazed on its sharp angles, jetties, narrow lights, lame statues, lace and other cutwork and crinkle-crankle and shall then turn his eyes on the Banqueting House built at Whitehall by Inigo Jones after the ancient manner."
>
> Wren's *Parentalia*, page 306.

With the changes of the social background and the shifting of the centre of society from the church to the courts, the spirit of true Gothic was almost reversed, although an early "Gothic revival" began in 1711,

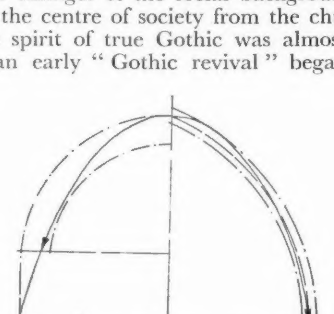


Fig. 1

Line of pressure with semi-circular and pointed arch

†*An instance of such enforcement is to be found in the death of a Bishop of Utrecht in Holland in 1099, who was killed by a Master Mason because his son had been induced to betray to the bishop the secret of how to lay out the foundations of a church.* (*Gwilt. Encycl. of Architecture 1876, p. 126.*) *This secrecy was not universally maintained in the later period as can be seen from the translation of Vitruvius by Cesariano 1521, where he inserted rules for the setting out of the cathedral at Milan.*

‡*See Suter : Kaiser Friedrich II and Kemal Eddin ibn Jûnis.* (*Erlangen 1922.*) *Anything resembling to an influence in the province of structural mechanics could not be traced, although in mathematics, philosophy, medicine, etc., the cultural intercourse between the Arabs and the European countries was essential for mediæval civilisation.*

when Louis XIV approved of a monumental scheme for a clock tower in Orleans on Gothic lines. But whereas in 1568 Gothic construction could be called "the modern way of vaulting" (Philibert de l'Orme) this art was completely forgotten by 1711. None of the five architects who spent their efforts on the building knew how to balance the thrusts, and finally, to save the work from collapse, the first project was abandoned, tie bars, supplementary arches and new walls and floors being utilised in the final design. (1778.)

In 1753 Walpole built Strawberry Hill, and Beckford in 1812, Fonthill Abbey (which subsequently collapsed). On all sides there sprang up houses that looked like churches or castles, ruins and mediæval towers were built and Gothic forms were imitated by skilled craftsmen. Even so, the spirit and structural principles of Gothic architecture seemed to be no nearer.

This principle is a truly revolutionary one, and very briefly it can be expressed by those words of Jean Mignot§ : Ars sine scientia nihil. (No art without science.)

The spiritual unity of the Middle Ages made it possible for mediæval craftsmen to build a new style within a century, slowly abandoning a thousand-year-old tradition and æsthetic convention, finding new functional solutions in a common effort, allowing full freedom for every one of them to achieve the common purpose in his own way. So they created a style without "inviolable rules," but professing the ordered liberty of the functional method.

THE FUNCTIONAL ASPECT—THE BUILDINGS

Vaults, Ribs and Keystones

The nucleus of structural difficulties for the mediæval architect was the vaulting of a high and wide space. The Gothic solution of this very ancient problem is a skeleton of ribs with light panel fillings, supported on isolated points.

The old Roman vault had to act as much as possible as a monolithic unit, which developed no thrust as long as the mortar held good. Additional loads on its sides helped the equilibrium as the line of pressure shows. (Fig. 1.) But increased weight means increased proportions of pillars and abutments ; monolithic construction means rigidity that is threatened with the danger of breaking up at any movement causing an alteration of interior stresses. As such movements are unavoidable in very tall masonry buildings (through uneven settlement of supports, wind pressure, movements in the foundations) this vaulting system offered great difficulties. The Gothic system solved all these difficulties by experiment and a true sense of the forces acting on the structural elements. Moreover, they solved the problems of vaulting on an oblong or irregular plan and the difficulty of shuttering required by the Roman groined vault.

In order to lessen the thrust of the arches and ribs, the weight of the vaulting panels had to be reduced. This was achieved by making them of a light, thin material. Light material is weak, therefore the best use of its section had to be made. If the best use of a section is to be made, the resultants of all forces must pass through its centre of gravity, the neutral layer of the vault, thus evenly distributing the load over the area of the section. Assuming a vault of even thickness throughout (which is a practical necessity) there exists only one line of resultant pressure which is independent of the form of the vault.

If the pointed vault is discussed, it is important to take its relation to the line of pressure into account. Fig. 1 shows the line of pressure and a semi-circular arch as well as a pointed arch inscribed in it. The pointed arch comes much nearer to the line than the semi-circular, it allows the force a thinner centre third, and consequently a lesser over-all dimension for the vault than for the barrel. The practice of building up a third to half of the height of the vault in horizontal courses helps to approximate the pointed section to the line. The last correction to the vault is given by a load in the crown of the vault (a heavy ridge rib, for instance) that will deform the line of pressure in such a way as almost to coincide with the vault. The line of pressure may be imagined as a rope suspended from the two supports of the vault and loaded like the vault. The form the rope would then take is the form of the line of pressure. Unless the vault is designed exactly to the line of thrust with its equation of

$$y = -h \times \log . \cos . \frac{x}{h}$$

which would certainly not be a practical way for a mason, one has to admit that the pointed vault, especially when loaded at the ridge and built on the *tas de charge* principle, presents the best solution of the problem.

The vault is 3 in. to 7 in. thick, according to span and its weight and thrust if taken by the rib.

Fig. 2 shows how the curvature of the rib can be arrived at. The rib carries all the panel strips and its own weight, but as the panels are not vertical, where they come down on to the rib, the rib has to convey the thrust thus exercised by the filling. The total horizontal thrust of a strip of the vault has to be resolved into one force at right angles to the rib (Fig. 3) and another one in its own direction, of which the first force has to be more or less neutralised by the corresponding force of the opposite panel ; if it is not, the rib suffers a deformation in its plane.

§ *Jean Mignot was architect to the cathedral in Milan in 1398.*

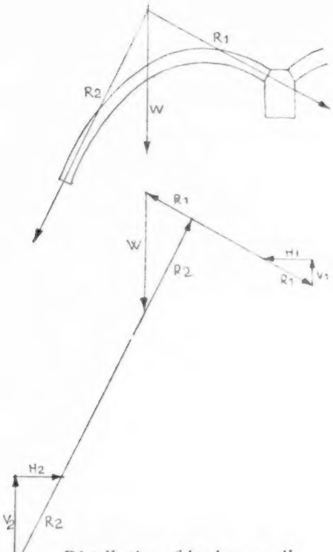


Fig. 2 *Distribution of loads on a rib*

After having established the weight and the thrust of the vault, the curve of the equilibrium is found for the rib, and again the form of the arched rib is fixed so as to deviate as little as possible from the line of pressure ; once more the pointed arch is found to be the most advantageous. (Fig. 3.)

The method of building up to a third of the height of the arch in solid horizontal layers allows the line of pressure to leave the centre line of the arch, and by the added weight of this " tas de charge " the line is directed further downwards, thus decreasing the thrust.

Looking up from the springing to the crown of the arched rib, we find again that the taller the arch the lesser the thrust, but the greater the necessary load on the keystone. This fact explains the strange features of some later French cathedrals, which tend to " épater le bourgeois " by enormous keystones that look like the springing of vaults without any support.

The fundamental idea of those steep arches and heavy keystones is quite structural, as the decrease of the resultant thrust is a most essential part of the solution of Gothic problems.

" Archispiguti non dant impulsum contrafortibus " is an argument put forward by Jean Mignot, whose

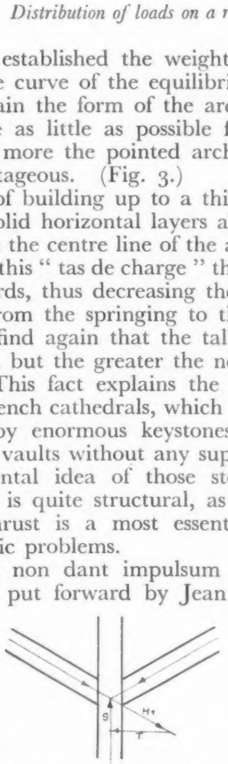
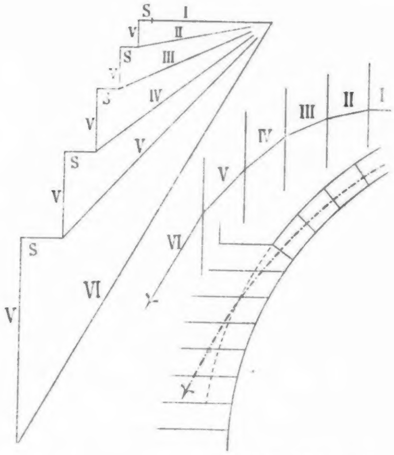


Fig. 3

Forces of a panel resolved



(from Mohrmann)

Fig. 4. Line of pressure in a rib

" ars sine scientia nihil " we have quoted before. Pointed arches do not give so much thrust to the abutments. The thrusts of round and pointed arches compare as about 5 : 2. (Fig. 1.)

The system of thin panels between ribs, vaulted by means of an ingenious sliding shuttering as described by Viollet le Duc logically leads to the effort of making the panels more or less equal in size and not too large, so that the interior stresses of the panels can be neglected, and that the deformation of their joints with the setting and hardening of the mortar has no effect on the ribs.

And so a more complex pattern of structural ribs was developed, which, however, remained functional even when it seemed full of inventive imagination. A few examples of such arrangements will be given. Fig. 5 shows a church, cruciform in plan. The bays of the nave are half squares, the centre bay, being the intersection of two naves of equal width, has to be square in order to equate the panels of the two neighbouring vaults to avoid excessive thrust on the front arch. This is one of the most frequently occurring patterns of early vaulting, and it is mentioned by Albrecht Dürer, *Weisung der Messungen* :

" As there are many who have a great liking for curious patterns for the good look of them, I will trace one hereunder."

The example shows another arrangement that proves essentially structural : whereas the nave shows double square vaults, the transept has sexpartite vaults. The thrust of the nave vaults is taken by buttresses, which transmit the horizontal force to the outermost abutments. The arch G H has neither the high walls of

the nave to counteract its thrust nor is it convenient to use flying buttresses for this purpose, as the only points of abutment within its reach would be the piers of the buttresses in the nave, which would be, or might be, overthrown by such strong force acting sideways. Therefore the sexpartite vault was chosen, which causes only one-third of the thrust to be taken by G H, whereas the main thrust is transferred by the diagonals to the supports 2 and 3, allowing free outer abutments.

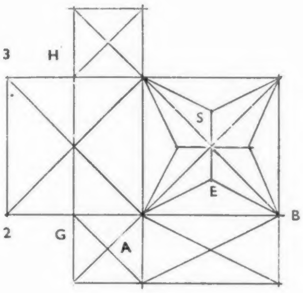


Fig. 5

If we pursue the logic of the first consideration for the star-formed central vault, the sexpartite cross-vault will have to take the form shown in Fig. 6, and this pattern would have to be repeated in the following bays.

A frequent reason for such fanciful structural patterns is the difficulty to connect the nave to the choir. In order to take the thrust of the point M in Fig. 6, the last bay dispenses with the diagonal ribs and connects the point M to the supports and B directly. The dotted lines mark the balancing ribs which will have to be added in order to keep the arch A B in equilibrium.

A more complicated system, which, nevertheless, is not arbitrary, and affords a very elegant solution of the problem of the connection between choir and nave,

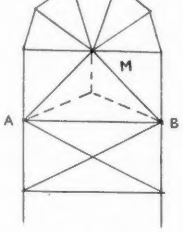


Fig. 6

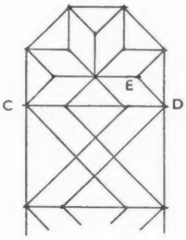


Fig. 7. Notteln

is given in the Church of Notteln, in Westphalia, of which Fig. 7 gives a sketch. Here the idea of keeping the thrusts of the panels in equilibrium has been extended to the diagonal ribs of the vaults of the nave, If a rectangular bay is vaulted, the diagonal ribs must depart from the bisecting line further the more oblong the plan of the bay becomes. In the Notteln church the bisecting line guides the tracing of vaulting to assure equal thrust from both sides of the rib. The rib, not being a diagonal, meets the front arch CD in E. Its thrust has to be balanced by a similar rib in the vault of the choir. This condition determines not only the plan of the whole choir, but presents the main feature of the church, and shows how far-reaching the results of structural logic are, even if applied to apparently minor elements.

Fig. 8 shows the plan of a vault which contains a stone ring instead of a keystone, as often occurs in towers, to allow a lift for building materials to pass. If the ring is small enough to be composed of only four freestones the diagonal ribs will suffice, if it is larger, each stone will be supported by a rib and thus the pattern becomes more starlike.

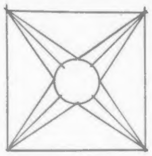


Fig. 8. Freiburg

In England the vaulting system called " fan vaulting " developed from the use of the same curvature for all ribs. The fans are formed by a segment of the chosen curve rotating round the spandril. The diagonal section of such fan vaulting would appear in the form of a " Tudor arch," the springings being struck with a smaller radius than the very flat top of the arch. The construction of those vaults is different from the early Gothic vaulting, in so far as the ribs are only reinforcements of the panels and worked in the panel stone, but otherwise it is geometrically developed, as are the other French vaults.

Although there is no scientific problem in builders' geometry, even in its most complicated penetrations, there is great foresight and common sense necessary to decide the various alternative solutions and to visualise beforehand what a complicated vault will look like.

In principle, the following points are common to all ribbed vaults. (The ribbed vault is to be considered as a trussed system in space, whose members must not suffer any tensile stresses. Fig. 9.)

(1) Any intersection of ribs must be situated above a plane through the springings of the ribs that support the point of intersection.

(2) Any intersection must be formed by at least three ribs, so that any one of them can be resolved in the direction of the other two.

(3) At any intersection of ribs, the centre line of any supporting rib must be at an angle with the horizontal.

Fig. 9 (*from Mohrmann*)
A vault as a trussed system in space

It would be impossible to attempt to exhaust all the possibilities of combinations and solutions which could be conceived on those lines.

Gothic building is a method, and the only thing that its examples have in common is the principle.

The section of the vaulting is constructed with dimensions varying according to the stress it has to take. It may be assumed that for the normal bay with diagonal ribs all four ribs bear equal compression. The necessary sectional area may be worked out, for an example, from the values that M. Guadet gives in his *Theorie de l'Architecture* for the weight of the vault of the church of St. Ouen, at Rouen. And the values thus found may be compared to the existing section.

The graph on Fig. 10 shows a plan of the bay to a scale of ¼ in. to 1 ft. with the true elevations of the arches. The rib that it is intended to analyse is the diagonal. The true form of the vaulting panels is developed and divided into strips I to V. The section of each strip of the vaulting panel is shown in the plan, and the forces that act upon the rib are determined by resolving the weight of the strip into the two directions of its reactions and resolving the reaction on the diagonal rib into its horizontal and vertical component. The vertical component, plus the weight of the corresponding piece of the rib, forms the vertical load for the rib. The horizontal thrust of the strip has to be resolved into one at right angles to the rib (which is taken, i.e., neutralised, by the corresponding thrust of the other vault) and the horizontal thrust in the direction of the rib which is added to that of the other panel. The funicular polygon, which is drawn from a polar polygon of those resultant forces, has been adjusted by trial and error till it has found its optimum form. The dimension of the rib, which allows the line of pressure to remain in the centre third, makes a minimum depth of 17 in. necessary, which is as near as makes no matter to the actual dimension of the rib as scaled off Guadet's measured drawing.

It will be found that I have omitted the action of strip No. 5 of the panel ; but the inclination of the panel ridge suggests a distribution of loads that will charge the wall rib with at least the amount of weight and thrust as represented by strip V. The weights of the panel strips being equal, the thrusts of the corresponding panels are taken as proportionate to the sides of the bay in plan.

It remains to determine the maximum stress on any point of the rib. The point that suffers most compression is the point A, which takes double the average pressure of its section because the line of pressure goes through the extreme point of the centre third, the average pressure being 158 lb. per square inch. The extreme pressure on the joint is 316 lb. per square inch, which is about as much as one may safely allow for a stone rib whose crushing stress is given as 3,500 lb. per square inch. Although it has to be remembered that this stress only occurs at one point. The rib can be considered as an economic working member.

The form of the rib section developed from a square to a more triangular shape, thus providing for the line of pressure. The main arches act as stiffeners between the outside walls. The relation between the diagonal rib and transverse arch is generally as 3 : 5, but the church of St. Ouen, which we have analysed, shows equal arches in both places, so that wind pressure would have to be transmitted by the vault.

Piers

Whereas vaults and ribs were obvious improvements on the traditional Roman method of vaulting, the remodelling of the supporting columns must strike us as a very daring achievement, even at a time when the proportions of the ancient order were not so sacred as they became later on. We have to keep in mind that all authority, Church, State, Law and all refinement in Art, was Roman heritage. But mediæval builders broke away, if somewhat reluctantly, from so powerful a tradition and formed a new functional conception of equal merit, the Gothic pier.

The forces which act on the pier are both vertical forces from its own weight, weight of roof, snow, vaults, and vertical components of wind pressure, the arches between the piers, etc., and horizontal components, the balance of thrust and counter-thrust of nave vault and flying buttress, and the thrust of the lower aisle. For these forces we will investigate the main section of one of the piers of the nave at St. Ouen, which we will take as an example because of the accomplishment displayed in this specimen of Gothic perfection. Moreover, as the book of M. Guadet already contains the weights and quantities for this building, it offers an easier opportunity for calculations than any other church. (Figs. 11 and 12.)

The balance of thrust and counter-thrust of the vault and the arch buttresses is 2.2 tons, the thrust of the vault being 8.2 tons and the counter-thrust of the arch being 6.0 tons. (Fig. 14.)

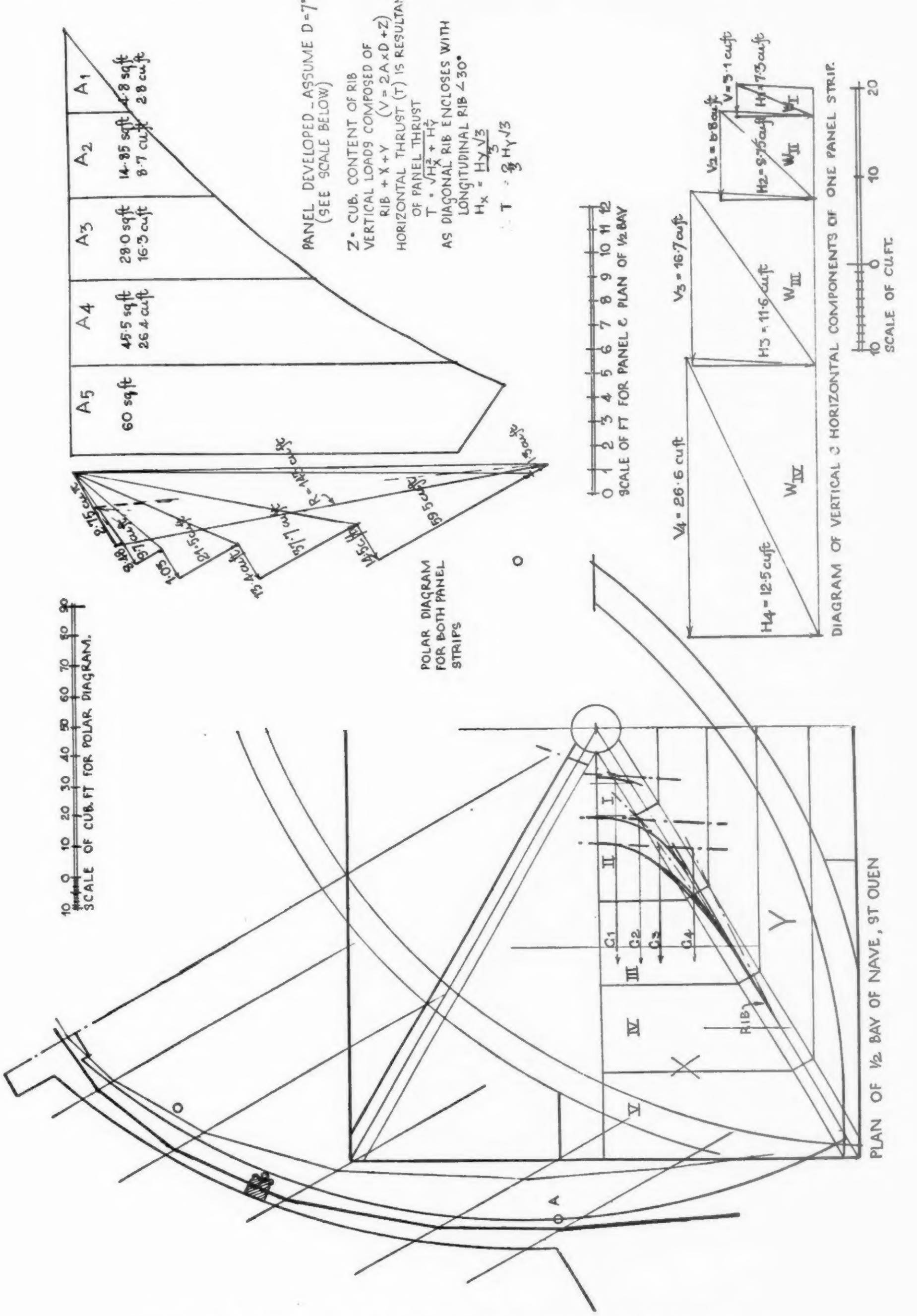


Fig. 10. Setting out of the line of thrust for diagonal rib at St. Ouen Rouen

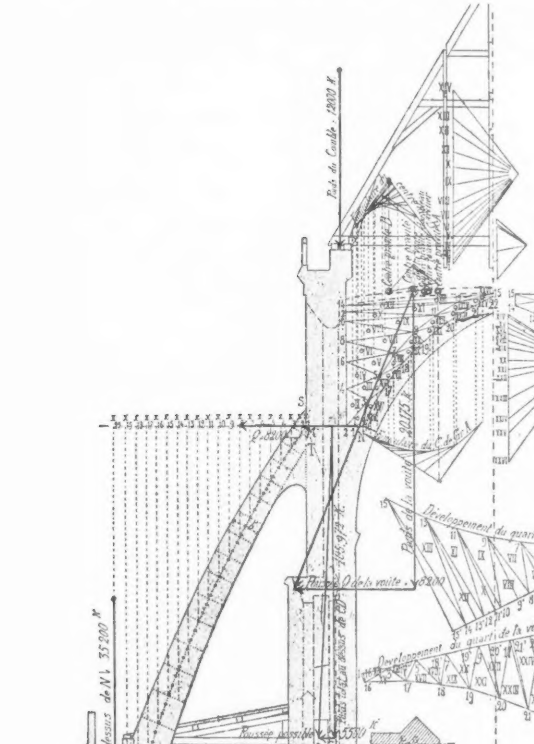


Fig. 11. *Section of St. Ouen in Rouen*

Assuming that all horizontal forces from wind and six tons of vault thrust will be taken by the buttresses, the vertical forces are as follows :—

Weight of nave vault ..	20.16	tons	(Guadet)
,, aisle ,, ..	3.4	,,	,,
,, pier and masonry arch	143	,,	
,, corbelled part ..	23.6	,,	
Reaction of flying buttress ..	5	,,	
Masonry above window ..	31.2	,,	
Weight of roof and snow ..	12	,,	(Guadet)
Vertical component of wind	2	,,	
	239.28	tons	

The area of the pier is 15.6 square ft. without taking into account the minor mouldings, which fixes the pressure at 240 lb. to the square inch. If the wind forces the pier to take its part of the pressure on the walls, the pressure will increase accordingly.

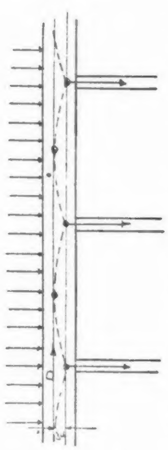


Fig. 13
Plan at A

(from Guadet)

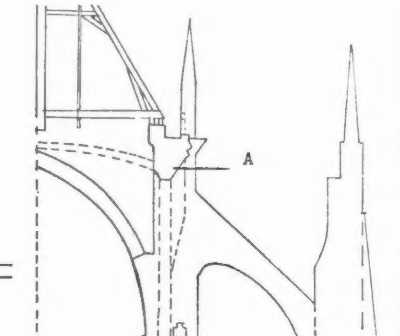


Fig. 12

The point where the resultant passes through the section at floor level is determined by the assumption that the total bending moment for this point must be naught. The distance of the point from the centre of the section may be x, then

$$x = \frac{2.2\times 1086 + 20.16\times 32 + 12\times 19 + 17 + 1.5\times 510 - 3.4\times 21 - 25\times 29 - 5\times 29 - 31.2\times 5}{239.28}$$

(This takes the thrust of the vaults into account.)

The cross-measurement of the pier is about 6 ft. (Fig. 10).

The eccentricity is x = 12.4 in., which is just on the limit of the middle third, and would increase the pressure on the compressed edge to 480 lb., which again is higher than we would allow nowadays, but within reasonable limits.

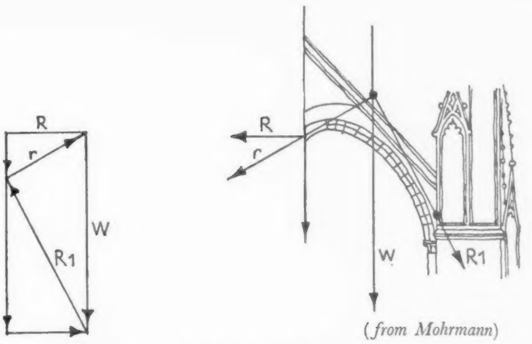
The construction of these piers varies. The high pressure of over 400 lb. per square inch that can be assumed for limestone has to be cautiously used in connection with the piers, because they used to consist only of a ring of stone and an infilling of small stones without bond in mortar. A slender pier like the one that we have investigated may be assumed to be solidly bonded, but in the next example a less solidly built pier showed bad cracks under its load.

For the pillars at the intersection of nave and transept we are helped by the accurate reports that have been worked out when the cathedral at Bayeux had to be repaired.

The lantern of the cathedral had to be supported temporarily by strutting, and its piers replaced by stronger masonry because the existing piers failed in compression, the foundations remaining perfectly sound. The superimposed load per pier was 900 tons, or an average of 270 lb. per square inch. Fig. 15 shows a sketch of the fractured section, and furthermore gives a good example of the construction of such pillars. The core is formed by the old Norman column that is left intact as far as it did not interfere with the new pier. The outside is formed by a ring of bonded free stones, and the space in between is filled in with rough stone work and mortar of little strength. The failure occurred by compression on the mortar and the weak parts of the old Norman vault that was left in the work. It appeared as conic shear failure, but one pier seems to have fallen more than the others.||

The most remarkable thing about this failure is that the donor for the erection of the lantern, Louis de Harcourt, Bishop of Bayeux, made his gift under the condition "ne si (quod Deus avertat) ex hac dicta superaedificatione aliquid ruinæ in posterum contingeret, sibi et suae huic devotioni quoquomodo valeat imputari." (That if (which God prevent) the superstructure should cause any future collapse, he and his building fund should in no way be held responsible.) Apparently, therefore, the bishop had expert advice on the limits of the carrying capacity of the piers.

||*The work of rebuilding is described in the Report, "La reprise en sous l'oeuvre de la Cathedrale de Bayeux, par M. E. Flachat." Paris, 1857.*

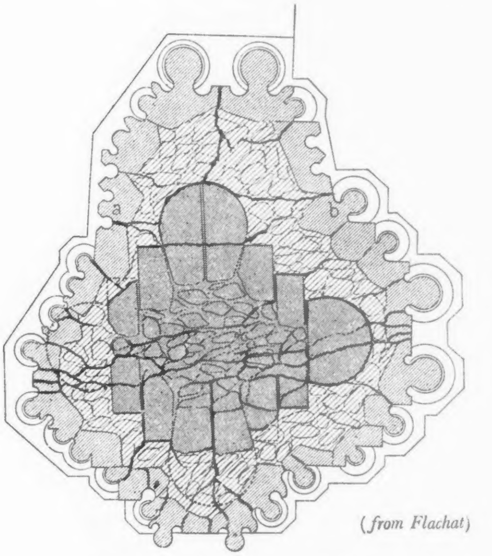


(*from Mohrmann*)

Fig. 14. Distribution of faces at St. Ouen

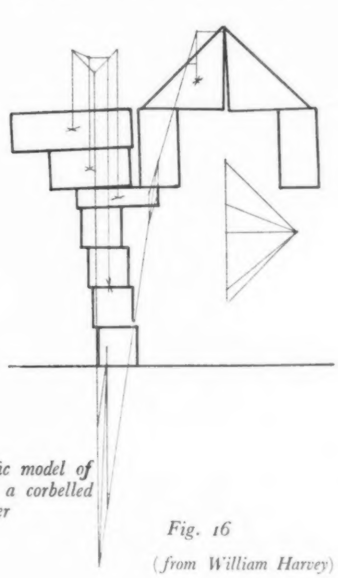
At Beauvais the large piers carry 12 tons per square foot over an area of 64 square feet. (Jackson.) It was obviously madness to superimpose the further load of a 500-ft. steeple on these highly stressed piers. It stood, however, for 25 years, when it duly collapsed.

The principle of Gothic corbelled construction is shown on Fig. 16. The sketch is copied from the book *Building Models*, by Harvey, and shows better than a calculation how very daring and fragile such a building is, whose every part is unstable for itself



(*from Flachat*)

Fig. 15. Pier in Bayeux Cathedral



Diagrammatic model of the action of a corbelled pier

Fig. 16

(from William Harvey)

and finds its equilibrium only in collaboration with the whole of the fabric.

The sectional area determines the size and also, in a lesser degree, the shape of the section as penetration of the ribs. The setting out of the moulding of the pillar as the ribs required is shown on sketch Fig. 17, from Willis's paper upon the vaulting in the Middle Ages. It shows the surface of a freestone after the mortar has been scaled off. The specimen came from St. Saviour's Church, Southwark, which was taken down in 1839. The lines are carved in the stone, and each one of the stones bears a similar setting-out graph. The method of arriving at such accurate sections is given by Philibert de l'Orme. (1568.) Each point is found by ordinates in a full-sized drawing of the true elevation of each arch.

The line of thrust, which alone affects the Gothic pier and takes the place of the vertical reaction of a

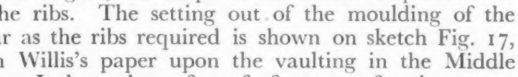


Fig. 17

(from Willis)

Setting out on a stone at St. Saviour, Southwark

lintel, is asymptotic to a vertical, and so no definite point is determined which would justify a change in the structure of the pillar. One cannot say at any particular point, here the column ends and the arch begins. Therefore the classic capital, with its symbolic expression of bearing, is out of place, and was reduced in size and sometimes even omitted.

Admiration for the ancient orders, however, eventually conquered the newly created code of forms, and in the 16th century we find many expressions of praise of:

stately Doricke columns
and neat Ionicke work. (Bishop Hall.)

Flying Buttresses

There does not seem to be much need to analyse the functional shape of the flying buttresses, because this feature of the Gothic construction, being the most essential for its stability, by its very position conveys its structural significance to anyone. In fact there are hardly any architectural or historical authors who do not realise this. The development of the arch-buttress is described by Corroyer, in his *Gothic Architecture*, as:

> "Rationalism—more apparent than real—which their authors carried to its extreme limits, casting to the winds all traditional principles and consequently all authority, passing from the triumphs of Amiens, Rheims and Mans to the supreme architectural folly of Beauvais and creating monuments not less amazing in dimensions than in the statical problems grappled with, if not always solved."

Corroyer calls the rationalism manifested in the flying buttresses more apparent than real. That, I take it, alludes to the fact that the thrust might as well be taken by tie bars as by outer buttresses. In fact, the Italian style of Gothic architecture chose this solution. The thrust of St. Ouen being 8.2 tons, a bar of 1 inch square would be able to cope with it.

But this view neglects the predominant force of the wind pressure. The wind pressure on the walls of St. Ouen amounts to 19.5 tons per bay and an additional 2.1 tons as horizontal component of the wind pressure on the roof. These forces exercise a bending moment of

$$M_w = 110' \times 2.1 \text{ tons} + 82' \times 19.5 \text{ tons} = 1{,}830 \text{ tons/ft.}$$

for the section of the pier at floor level; whereas the moment that the thrust of the vault exerts on the same section of the pier amounts to

$$M = 95' \times 8.2 \text{ tons} = 780 \text{ tons/ft.}$$

That means that in a strong wind, on the side affected by the wind, not only would there be no vault thrust at all but an overbalance of 8.6 tons per pier in the other direction, which would have to be taken by the vault or the roof and transmitted to the opposite wall and its flying buttresses.

The wind pressure explains the series of flying arches arranged in different storeys, one on top of the other,

and the high position of the topmost of them above the point where the thrust of the vaults acts. (Fig. 18.)

Tie bars would not be able to take this force, as can be seen from the above data, and tall northern cathedrals

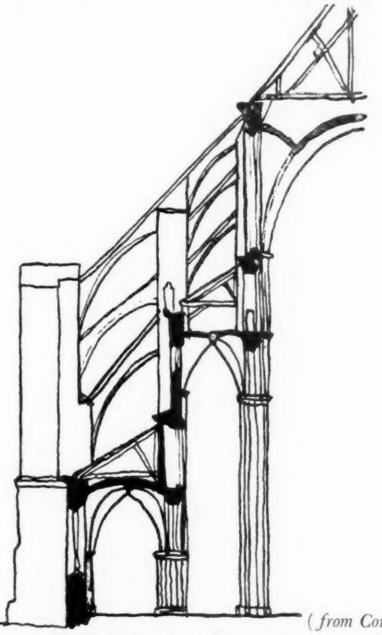


Fig. 18 *(from Corroyer)*
Flying buttresses at Bourges

could not be without flying buttresses. Tie rods were fixed only during the construction until the vaults had settled down to their final form, and then were removed.

The flying buttresses and outer abutments are the most decisive features of the external elevation of a Gothic church, and more than in any other member is the creative power of the functional principle apparent in its form.

The arch generally consists of a lower part that follows the line of pressure more or less closely, and a straight upper part that is used to convey the water from the roof over the lean-to of the side aisles and through long-necked gargoyles away from the foundations. But these straight copings also take the flatter line of pressure for wind. (Fig. 19.) The two elements are, theoretically, independent of one another as long as each one of them is rigid enough to avoid any buckling or springing in the case of a sudden increase of the load. The stiffening in this case can be done by a series of columns or stone tracery between the two parts of the arch, leaving the unstructural centre light and open and yet providing for utmost efficiency. (Fig. 20.)

Fig. 14 shows the arch buttress of St. Ouen. It can

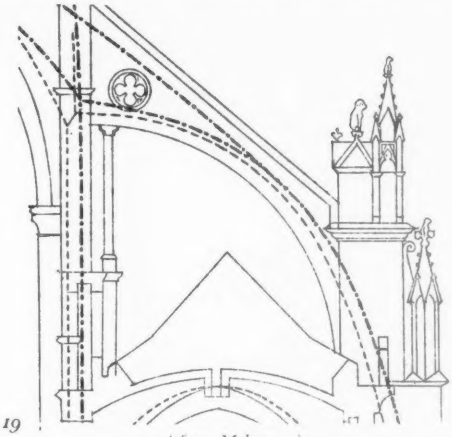


Fig. 19 *(from Mohrmann)*
Line of pressure in flying buttress at Strasbourg. With wind, stroke and dot; without wind, dotted

be seen on Fig. 16 that the height of the intake of the thrust coincides with the first point of the line of pressure in the arch. The resulting forces of the arch, being resolved into vertical reaction and horizontal thrust, show the latter to be about 6 tons. The thrust of the vault being 8.2 tons, the balance of 2.2 tons remains, which gives a compressive force of 2.6 tons on the section of the arch. The wind pressure, that first attacks the wall opposite, will partly be taken by the pier on the wind side. The resultant line of pressure may be allowed to pass from an eccentricity of 12.4 in. as the vault thrust produced it without wind pressure

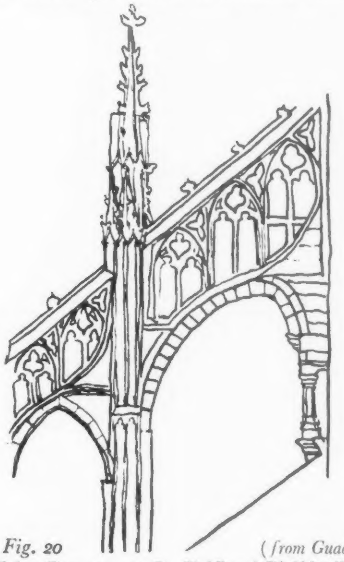
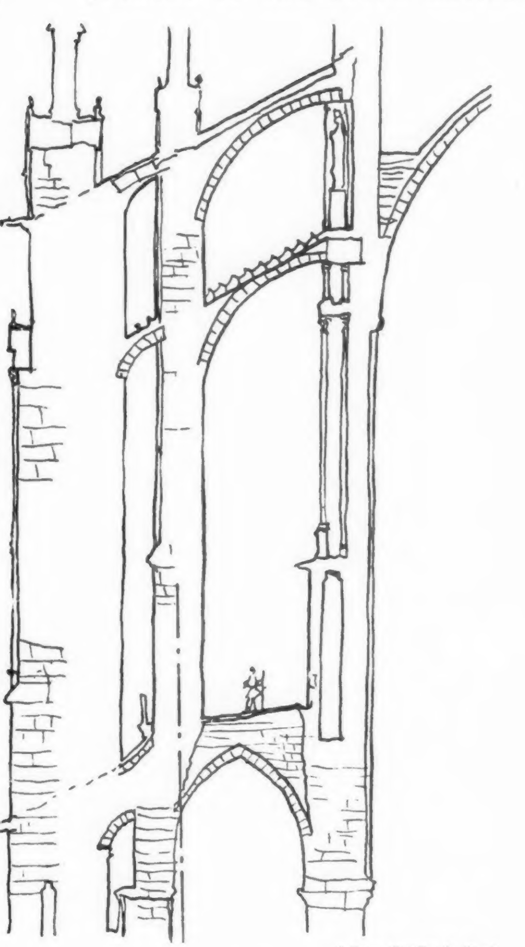


Fig. 20 *(from Guadet)*
Flying Buttresses at St. Vulffrand D'Abbeville



(*from Viollet le Duc*)

Fig. 21. Choir at Beauvais Cathedral

into an eccentricity of 12 in. on the other side of the centre of gravity. That would mean that the pier would not suffer tension in any joint. It could then take 5.25 tons of the resultant wind thrust in the height of the intake of the vault thrust, leaving

$$8.6-5.25=3.35 \text{ tons}$$

to be resolved into vertical and arch components, which latter amounts to

$$\frac{3.35}{\cos 47^{\circ}} = 4.05 \text{ tons.}$$

Adding the 2.6 tons from unbalanced vault thrust, the stress in the arch is 6.65 tons on an area of about 1′ 8″×3′ 3″. 5.4 sq. ft. at the narrowest point or 191 lb. to the inch, with a maximum compression of up to 380 lb. in the upper part of the section. This buttress proves to be on the safe side, although by no means uneconomical, but how near the limit the sizes of the arch buttresses generally were is shown by the frequent failures and collapses, of which Amiens and Beauvais may just be two instances, and the necessity for reinforcement as (1880) in Soissons, Mans and Rheims.

Corroyer calls it the " architectural folly of Beauvais," and, in fact, the building with its interior height of 160 ft. and its three rows of flying arches one on top of the other may exceed the measures of safe building. (Fig. 21.) It is well known how the whole nave collapsed on 29 November 1284. The reason may have been the excessive corbelling of the piers which caused the flying arches to snap and the vaults to give way.

But if contemporary critics blame the ambitions of the architects of Beauvais, our own generation might as well be blamed for the building of bigger and still bigger ships, which shows the same engineering spirit of going up to the possible limit of a structural method.

After all, the strange beauty of the choir of Beauvais seems to justify this entirely functional building in which there was very little space for mere æsthetic consideration, very little factor of safety, and which was as much an engineering structure in stone as Limousin's famous Zeppelin hangar in concrete or the Forth Bridge in steel.

Vertical Abutments and Pinnacles

The system of balanced thrust in the transverse section is incomplete unless the rigidity of the series of " principals " is assured in the longitudinal section as well. Therefore the masonry above the great windows which fill the space between the piers has great importance for the stability of the building. The height of the strip of masonry above the height of the crown of the windows is more or less fixed because the tie beam of the roof truss must be kept clear of the upper surface of the vaults. The fact that the arch has to transmit all possible forces in the longitudinal direction makes it advisable to weigh the crown, thus decreasing the danger of the arch breaking in the middle.

Another solution of the same problem is the addition of an outer concentric arch, which increases the width of the wall in this critical point. The outer arch will then be crowned by a triangular gable to throw off the water and carry for weight the pinnacle on top. (Fig. 22.) This feature is a rather characteristic one.

The thrust of the vault and the horizontal component of wind pressure on the wall produce a line of thrust in the plan of the arched wall. (Fig. 13.) This line is not the level but dropping towards the buttresses. The arch has therefore to be thick enough to accommodate the line of pressure that the wind produces, and the arch buttresses have to reach high enough to take the pressure off the walls without allowing a bending moment to act upon the wall. This reflection is carried through in much detail in Mohrmann's book *Gothische Konstruktionen*. Mohrmann gives a formula which allows the

determination of the approximate point where the resultant wind pressure comes into action. If we call

e, the distance of the point below the highest point where thrust is transmitted,
c, the centre third of the wall,
Q, the total vertical load, and
S, the total horizontal force,

then the proportion

$e : c = Q : S$ is approximately right.

$$e = \frac{c \times Q}{s} \text{ (Q=45 tons masonry + 12 tons roof, S=8.6 tons from wind + 1 ton from vault, } c = 1'\ 6'')$$

$e = 8'\ 10''$

It is surprising that this calculation justifies entirely both the great thickness of the crowning arch and the high position of the upper part of the flying arch. M. Guadet, in *Elements de l'Architecture*, has worked out a modern buttress according to the lines of thrust. But his buttress, although being lighter, does not account for the wind pressure thus transmitted, and the corresponding value for his buttress is $e = 13'\ 0''$. (Fig. 11.)

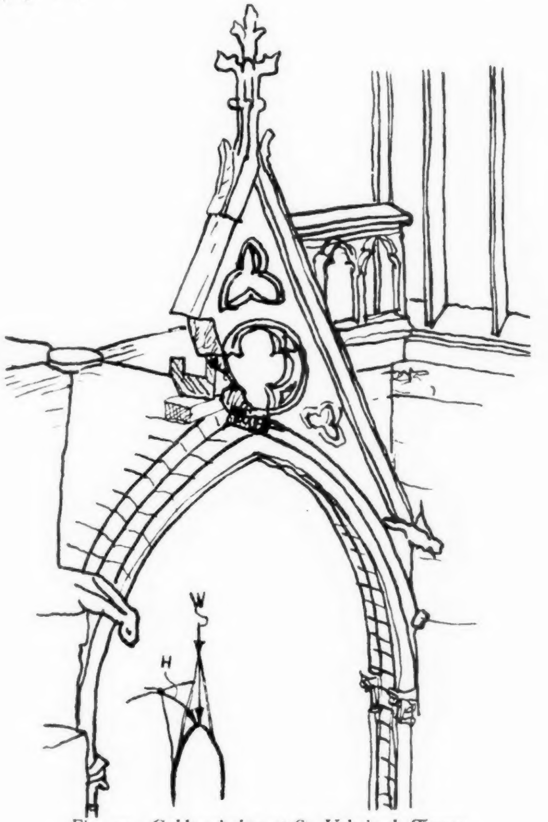


Fig. 22. Gable window at St. Urbain de Troyes. (From Viollet, le Duc)

The only element of the structure that gives the impression of unlimited reserves of strength is the vertical buttress that guarantees the strength of the whole building. Here the stress of all the external forces is collected, and yet even those enormous masses of masonry are almost as near the economic limit as any other member.

Failures of buttresses have occurred, if not in compression, then in shear; the horizontal thrust tends to move the masses of masonry, and although the steep slope of the flying arch prevents the buttress from shearing as soon as the mortar joints are hardened, there is considerable danger as long as the mortar remains soft, and only temporary tie bars and heavy superimposed loads will prevent the shear force from governing the dimensions of the pier.

We have examined the buttress of St. Ouen in a fairly detailed calculation for shear, resistance against bending and maximum compression.

The thrust will not exceed 18 tons in a strong gale, which is spread over an area of about 12 sq. ft., leaving a theoretical shear stress of 7.2 lb. to the square inch, which is well within the permissible limits.

The bending moments for the point B in Fig. 12 are composed of the weights and thrusts and their distances from the point. Call the vertical forces V and their distances b, and then the horizontal forces H and their distances a, then is

$$x = \frac{\Sigma Vb - \Sigma H.a}{\Sigma V}$$

the distance of the resultant force of the point B.

This is the list of forces and distances :—

Vertical components of thrusts conveyed through flying buttresses	$V_1 = 20$ tons.	$b_1 = 13'\ 0''$
If without wind	$V_2 = 16$,,	
Vertical component of thrust of aisle	$V_3 = 3.4$,,	$b_3 = 13'\ 0''$
Reaction of weight of arch ..	$V_4 = 10$,,	$b_4 = 13'\ 0''$
Weight of pinnacle and superimposed masonry	$V_5 = 34$,,	$b_5 = 7'\ 10''$
Weight of bulk of buttress ..	$V_6 = 172$,,	$b_6 = 7'\ 10''$
Weight of projection outside ..	$V_7 = 16.2$,,	$b_7 = 1'\ 7''$
Weight of projection inside ..	$V_8 = 21$,,	$b_8 = 13'\ 0''$
Hor. thrust because of wind ..	$H_1 = 3.35$,,	$a_1 = 82'\ 0''$
because of own weight of arch buttress	$H_2 = 5$,,	$a_2 = 78'\ 6''$
because of nave vault ..	$H_3 = 8.2$,,	$a_3 = 77'\ 0''$
because of side aisle vault..	$H_4 = 1.5$,,	$a_4 = 42'\ 6''$

Σ Vb = 2,360 tons/ft. and without wind 2,304 tons/ft.
Σ Ha = 1,367 ,, ,, ,, ,, 1,089 ,,
Σ V = 276.6 tons ,, ,, ,, 272.6 tons.

$$x = \frac{2360 - 1367}{276.6} = 3'\ 7''$$

and without wind

$$x_1 = \frac{2304 - 1087}{272.6} = 4'\ 4''$$

B

If no wind pressure is conveyed the line of thrust goes exactly through the limit of the centre third, which is a third of 13′ 0″=4′ 4″ from point B.

If a strong wind acts on the building the line leaves the centre third but remains within the centre half, which is 3′ 3″ away from the edge, the pressure is low

$$\frac{272.6}{45 \text{ sq. ft.}} = 94 \text{ lbs/sq. in.}$$

with an edge compression of 188 lb./sq. in. and in case of wind pressure up to 270 lb./sq. in. and 40 lb./sq. in. tension on the opposite edge.

In practice the centre half is always allowed for good masonry, and we can consider the buttress to be as economically dimensioned as it might be under the circumstances.

The stresses for the buttresses of Amiens and Strasbourg have been investigated and show a still closer approximation to the safe limit. (Fig. 29.)

The stepped silhouette of the buttresses of Chartres Cathedral, and the weighing pinnacles in St. Ouen, and on most other buttresses, are all varying solutions of the same question of balancing the thrust. The weight of the pinnacle in the case of St. Ouen is 34 tons. Its effect can be increased by placing it as far back from the outer edge as possible, and some churches show the pinnacle bearing on the flying arch. Other, still more daring, constructions show the whole of the upper part of the buttress corbelled towards the inside of the church, from the level of the top of the lower aisle onwards.

The buttresses effected an alteration of the plan in so far as the valuable space between them was filled with a row of chapels, which are low enough to allow a window above to light the lower aisle. Thus, starting from a minimum height for these chapels, the height of the side aisle and the main aisle were more or less determined, and the cycle of causes and effects established a traditional arrangement which presented almost a standard type of building without restricting the variety of important individual details.

Windows

Ordered liberty rules the formation of the windows of the Gothic cathedral. With the invention of glass, windows could be enlarged without fear of rain and wind; and as the glass could not be made clear, it consequently was preferred coloured rather than in colourless obscurity (which, however, the order of Citeaux prescribed) and the amount of light was much diminished. This determined the size of the windows. There was no reason to keep any of the solid wall space between the piers and the whole panel between the walls could be transformed into one big window. The reveals of these windows, splayed in plan for better spreading of light, were moulded to keep the rain off the surface of the window with its many lead joints, which were particularly endangered by driving rain, and the water that ran down the wall was diverted by a gable over the head of the window that threw it off sideways. The pointed vault of the nave was logically taken up by the pointed arch of the window, which came as close to the underside of the vault as the reveal allowed; the latter naturally continued round the arch. Panes were made in sizes not much over 8 in. square, lead glazed panels had to be no larger than 2 ft. 6 in. square if they were to be rigid. This made the introduction of stone mullions necessary and determined their distance within narrow limits. Horizontal iron window bars of very economical sections kept the horizontal joints of the window panes in position, and their necessary arrangement in some round or pointed stonework forms the only pattern of the window.

One of the most remarkable parts of early Gothic construction is the construction of this stonework which had to keep the window panes in position, so close it is to the proportions calculated for the stresses that actually occur. These slender mullions, whose section is generally formed on the same principle as the reveals, its lateral dimension being about half that of its longitudinal, which is a wind-resisting dimension, are stressed by their own weight and the weight of the tracery they have to carry. The tracery is grooved into the stone arch and reveals, allowing some play similar to a wood panelled construction.

The masonry of the piers and window reveals tends to settle more than does the slender work of the mullions, which are built up of fewer courses. The weight of the settling window arch would cause the mullion to fail in compression immediately. Therefore this loose fixing of the tracery is essential.

The weight, which must in no place exceed the safe limit, has to average half of the permissible stress, as the wind pressure will bring the line of pressure up to the limit of the inner third and thus double the stress.

For short columns, up to about 30 times the least cross dimension, the compression only may be calculated. The more slender mullions have to be further calculated for buckling according to the Euler formula

$$\text{Permissible load} \qquad N = \frac{\pi^2 EI}{l^2}$$

and allowing for at least 10-fold safety. The modulus E may be taken as 8,000,000 lb./sq. in., 540,000 tons/sq. ft. for stone, I is the moment of inertia of the section, l the length of the pillar.

As the window bars keep the mullions from buckling sideways, the maximum moment I may be used in the formula.

If the vertical pressure has to be kept low for the sake of the safety against crushing, the wind pressure on the surface of the panes exerts a horizontal force on the mullions that has to be counteracted by a weight. So there are limits of maximum and minimum loading, the difference between which grows less in ratio to the

slenderness of the mullions, till there is only one solution to the problem.

The minimum load is thus arrived at (Fig. 23) :—The wind pressure on the surface of the window produces a bending moment in the mullion that is determined according to the formula for the maximum bending moment of an evenly distributed load. This moment produces a line of pressure in the mullion. As the mullion is not allowed to suffer tensile stresses, this line has to be kept within the centre third of its section. In order to keep the resultant force within the centre third, the moment $\frac{Wl}{8}$ has to be neutralised by an opposite moment $D \times \frac{1}{3}d$ which means

$$D \times \tfrac{1}{3}d = \frac{Wl}{8}$$

D represents the minimum load that will prevent the stone mullion from bending under wind pressure and allowing any joint to be stressed in tension.

The following is a calculation for the slender mullions of the windows in Sainte Chapelle in Paris. (Fig. 24.)

The dimensions of the mullion scale as follows :—

Height $h = 37'\ 5''$
Width $b = 8''$
Depth $d = 1'\ 4'' = 2b$
Area $A = 147$ sq. ins.

Assuming that the iron window bars prevent the mullion from buckling sideways, the inertia moment for the depth 2b is

$$I = \frac{5b^4}{12} = \frac{5}{12} \times 8^4 = 1{,}690 \text{ in}^4$$

As the height of the mullion $h = 28.5$ times its depth, the permissible load has to be determined by the Euler formula

$$\text{Permissible load } N = \frac{\pi^2 EI}{s.h^2}$$

E = Modulus of elasticity, about 185,000 tons sq. ft. (Unwin.)
$I = 1{,}690$ in^4.
$s = .75$ (condition of end fixing).
$h = 34'\ 6''$.

$$N = 14.25 \text{ tons.}$$

Factor of safety 10, maximum load thus 1.42 tons. (Fig. 22.)

This is the minimum load assuming a low wind pressure, because of the sheltered position of the chapel in a large court of the Palais. The ordinary wind pressure of 40 lb./sq. ft. would bring the minimum load to 1.9 tons, slightly above the permissible maximum although within reasonable limits. The actual load on the mullions of Ste. Chapelle from weight of mullion and tracery at half-height where the greatest bending moment occurs is

$$W = 1.08 + 0.56 = 1.64 \text{ tons,}$$

taking our usual 139 lb./cu. ft. of material.

The result of this calculation may be at variance with the actual facts in so far as the modulus of elasticity and the weight of the stone in question, the factor of safety, the wind pressure, may be slightly different from those assumed. But the tendency is definite that the section of the mullions, the height between sill and crown, the amount of tracery are definitely related to structural necessities. A series of similar calculations on theoretical examples have been made by Mohrmann, *Ungewitter* (Leipzig, 1903) showing how accurately balanced the stresses in Gothic windows were by the mere gravity of their elements.

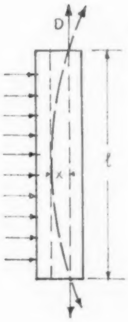


Fig. 23

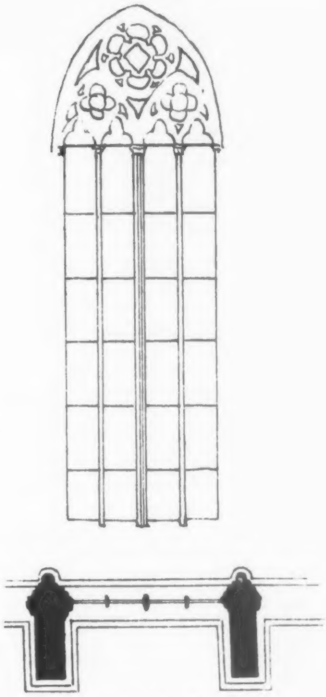


Fig. 24. Sainte Chapelle

Ruskin asserts, in his *Lamp of Truth*, that the lower windows of St. Ouen are held together with iron cramps and are exaggeratedly slender. The mullions would not stand wind pressure by their own weight. The upper windows, however, containing an open Triforium gallery, seem well to be strong enough.

If a window is taller than 15 ft., horizontal reinforcements become useful, and cross pieces of the same section as the mullions may be used up to 15-ft. window space below and above the reinforcement. Beyond these limits galleries have to be introduced, which are useful because they give access to the windows. If any Gothic window tracery is examined it will be found that the economic distance between horizontal stone-

work reinforcements is seldom exceeded, and slender columns as in Sainte Chapelle are rare.

For the detail, the cusps seem definitely to be inserted to strengthen any slender concave pieces of stone, and their methodical use leads to the apparent complication of geometrical patterns that in themselves are most logically developed from the form of the surrounding arch and the required weight on the mullions.

Wherever a wall does not form part of the structural skeleton and is free from incumbent weight, tracery is used. So it occurs first of all in the west elevation, which, in fact, is only a light curtain and not a structural wall at all, and it occurs in the curtain walls under the windows, in the light gables that shelter the window arches and in the railings of galleries.

The construction of the west elevation and the placing of the towers is a most ingenious solution to the problem both of structure and design. There is, in fact, no indication in the vaulting system itself of how to put a final stop to a row of equal bays, how to take the thrust of the last bay or how to close the space between the piers. The stability of the whole series of vaults depends on the solidity of these last abutments. If the westernmost vault were to give way, one bay after the other would collapse.

The west front of the nave gave the best possibility of ample lighting of the inside of the church. There, a whole wall, free from structural tasks and unhampered by the obstructions of aisles and buttresses, could be transformed into one enormous window, only limited in size by the wind pressure and the space allotted to the main doors. The large window, either round as in French cathedrals, or pointed as in German or English buildings, produced a curtain wall of utmost lightness. Viollet le Duc states that a square foot of the surface of the great rose of Notre Dame in Paris only contained .37 cub. ft. of stonework or 46 lb. of material.

The section of Amiens shows the thin central wall and two series of galleries inside and outside that give stability to the lower part of the west curtain wall, allowing it to be very slender, whereas the big rose window, thus supported, fills the whole of the upper part. (Fig. 25.)

Towers and Steeples

The towers that form the final abutments of the last bay of the vaulted nave are generally made to contain the large bells for which, in the earlier periods, a separate belfry had been erected. But even if no bells were housed in the western abutments, as in the churches of the Order of Citeaux, turrets, weighed by pinnacles, were necessary at the ending of the nave.

Some great French cathedrals have flat terraces on top of their towers, and thus it has been a point of discussion whether they were intended to remain at

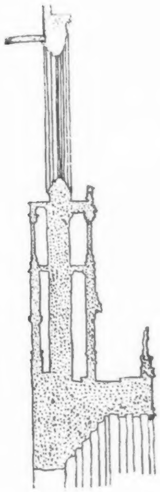
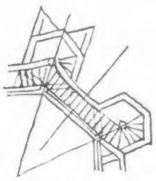
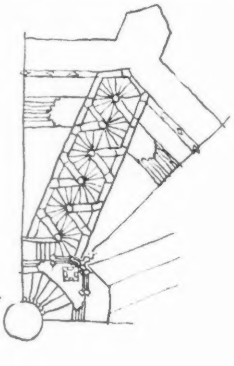


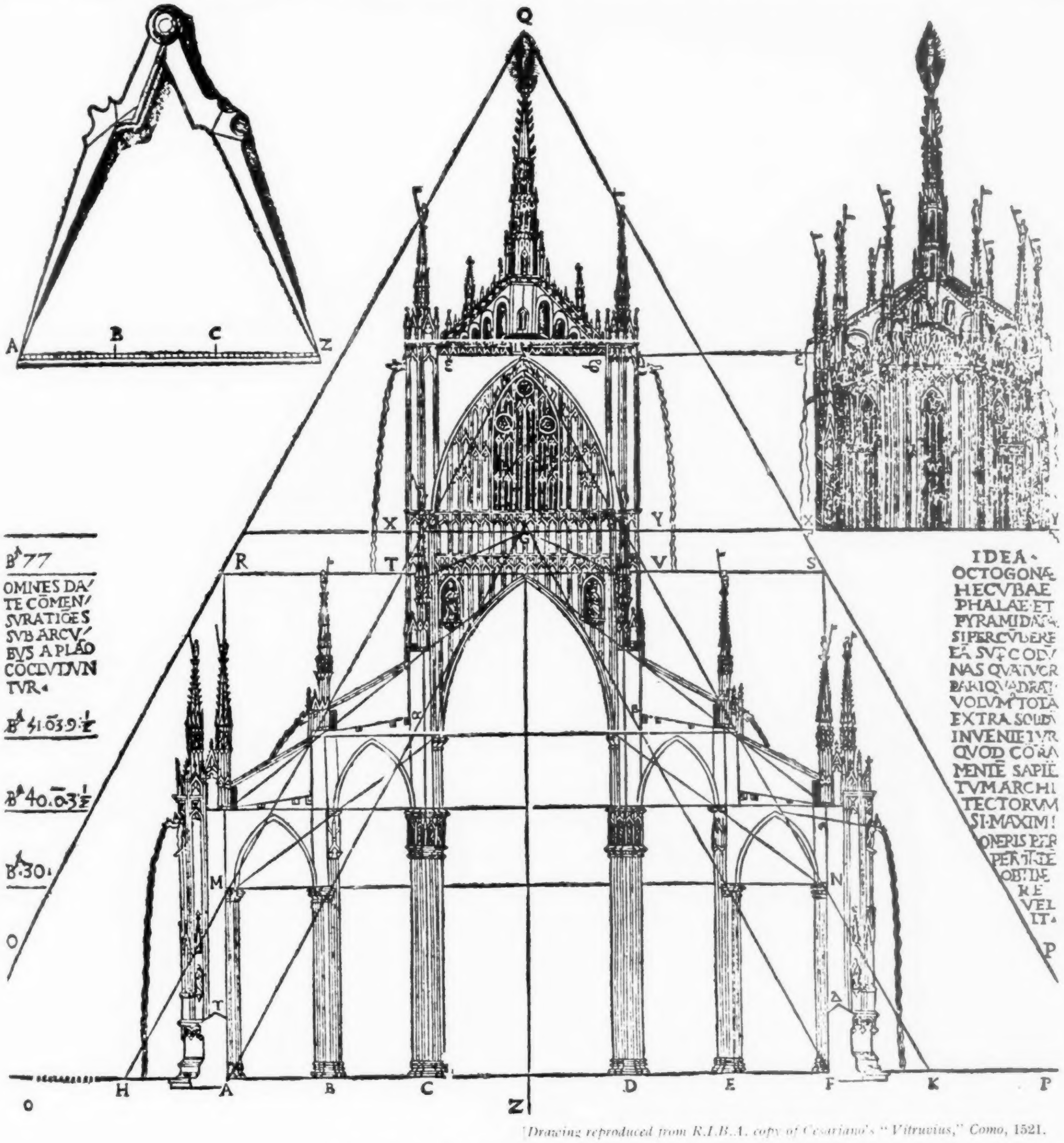
Fig. 25. Section through Amiens N. Wall

this stage or whether they were intended to be carried farther but were left incomplete. However that may be, if a steeple was intended it would have had to be as light as possible and its walls as thin as possible. The best form for a spire is a cone. In the cone all the stresses remain in the centre, and theoretically there is no limit to the thinness of its skin. But in practice a cone is a difficult piece of masonry, and the next best solution is the octagon, but this has a disadvantage, wind pressure on its ridges produces a line of pressure that tends to push the ridges outwards. That force has to be corrected by the weight and strength of the ridges. The crockets that are so characteristic of Gothic steeples help to weigh the ribs. The interior and exterior projections strengthen it and allow the skin of the spire to be about 1/30 of the clear span, which comes very close to the possibilities of the conic spire. The weight thus added to the ridge ribs can be further increased in the most useful manner by





Figs. 26 & 27. Part plans of the steeple at Strasbourg



[Drawing reproduced from R.I.B.A. copy of Cesariano's "Vitruvius," Como, 1521.

Fig. 28. EXPLANATION OF DRAWING

The triangular method as by the points A, B, C, D, F, of the equilateral—in G is the perpendicular marked ZG—wishing to give the walls more than adequate degree of strength set on A towards H = 16 parts in like manner, and 16 parts F towards K in like manner, joining HK which is to the base of the equilateral triangle HLK the apex L being the height of the arch from the base—also AFG placed on the capitals of the pillars to the lower aisles M to N will likewise have its apex in L—also AFG placed on RS which is a line passing horizontally through the apex of the vaulting of the nave will give the height of the spire the whole forming the great triangle OPQ. TV marks the heads of the canopies and width of the great tower, ab indicate the arch of the nave. YM and ND are the places for the lower windows. This was the rule which the German architects used in building the great church at Milan

loading the ribs with a part of the weight of the filling. Arches are constructed from rib to rib with or without openings beneath them. From the panels to the trussed system of utmost lightness and minimum wind pressure it is but a step. Examples of this latter system can be seen at Vienna, Strasbourg, etc.

The open structure of these steeples allowed the rain to enter, but so did the large sound openings of the bell-chambers, and there was nothing in those bell-chambers to be damaged by the rain. The height was important, and nothing was thought magnificent that was not "high beyond measure," as Sir Christopher Wren describes it. The desire for height, the "folly" of Beauvais, made the pierced work of the 15th century spires essential because of its lightness. All the other features of the Gothic spire, pinnacles and buttresses, gables and tracery, obey the same principles as they do for the construction of the body of the building. Utmost lightness, with increasing height, is their only distinction, and I do not think it necessary to calculate any of them and to determine how near they are to the safe limit of stresses, because the engineering spirit of these "trussed towers" is obvious. (Fig. 27.)

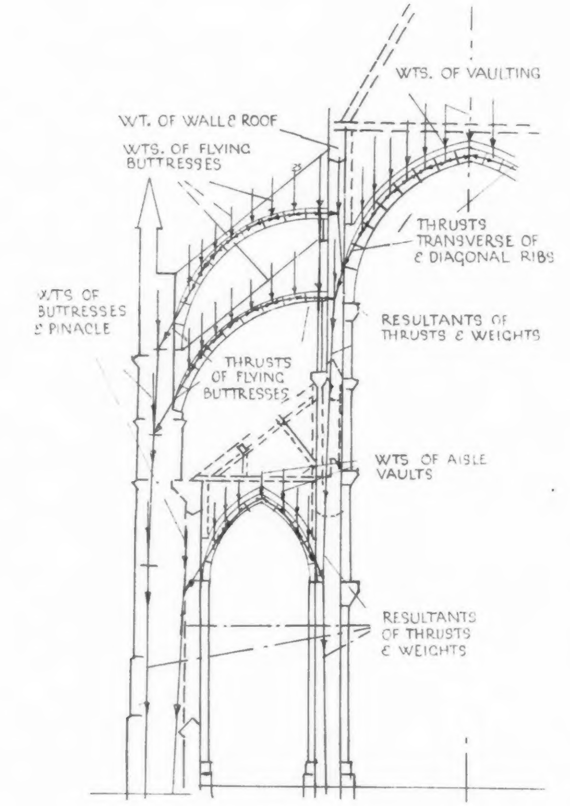


Fig. 29
Diagram showing typical lines of thrust in a cross section of a Gothic Cathedral (Amiens)

The final portion of this article dealing with the Gothic builders, their drawings, organisation and codes of rules, will be published in the next number of the Journal.

EXPERIENCE IN SOUND INSULATION

By CH. MÖLLER, ARCHITECT, D.SC.TECHN., BUDAPEST

In this paper, which is a companion to the one on " Heat Insulation " published in the Journal of 12 October 1935, the author furnishes some interesting facts derived from seven years' practice in investigating noise nuisance cases. He refers to the excellent B.R.S. paper on " The Reduction of Noise in Building," and also to the second conference of the Anti-Noise League with its publications.†*

It is assumed that the fundamental principles of sound insulation need not be explained here, but since many architects are not sufficiently conversant with the units of noise measurement, and since, on the other hand, physical units cannot express the degree of annoyance caused by a noise, a brief introduction on noise and vibration may be useful.

NOISE AND VIBRATION

The *physical sound-intensity* (I) is the flux of sound-energy, *i.e.*, the sound energy per unit surface per unit time, *e.g.*, ergs/cm². As the intensity is proportionate to the square of the average sound-pressure per unit surface, it is more convenient to use the sound-pressure as a physical standard, as it can be measured by comparatively simple instruments.

The *loudness* (L) is the impression which sound-pressure makes upon the hearing system of the ear. This impression is not at all proportionate to the sound intensity : it varies with the age, the sensibility, the nervous state of a person, but especially with the frequency (vibrations per second) of the sound. The " Kingsbury curves " show, for the same observer, the sound energy which causes the same effect of loudness at various frequencies.

According to the Weber-Fechner law, tested repeatedly, with the same pitch and under the same circumstances, *the loudness increases with the logarithm of the intensity.* Thus, the logarithm to base ten of 1 being 0, of 10 being 1, of 100 being 2, etc., it is obvious that when multiplying the intensity by 10, the loudness is increased by one logarithmic unit. This unit, the *bel*, is too great, and its tenth, the *decibel*, is used instead.

The decibel expresses a difference measured on the linear loudness scale, or 10 times the logarithm of the ratio of intensities or 20 times the logarithm of the ratio of average sound pressures :

$$L_1 - L_2 = 10 \log \frac{I_1}{I_2} = 20 \log \frac{P_1}{P_2} \text{ decibels.}$$

The decibel expresses a difference, and does not mean any definite loudness, unless referred to a known datum level. To cite an analogy : if we are told a hill is 550 ft. high, we do not know its real height ; we have to add : " above sea level " or above some other reference level.

In architectural acoustics, developed by W. C. Sabine's aural methods, the reference level of loudness was the *threshold of audibility*, and the expression " the loudness of a sound is 60 decibels " meant that it was one million times more intense than a barely audible sound of the same pitch and quality ($10^6 = 1{,}000{,}000$). As we are planning acoustics to satisfy, and sound insulation to protect, the human ear, the author believes that the threshold of audibility is the proper reference level for calculations of loudness in architectural acoustics.

In electro-acoustics (telephony, radio, talking-pictures) it was felt that loudness figures based upon the threshold of audibility do not give results comparable with the electric output of apparatus, the threshold of hearing varying very much with the frequency. According to Fletcher (Fig. 1), the threshold of audibility corresponds to a sound pressure of

3	dynes per cm²	at		32	cycles
.035	,,	,,	,,	128	,,
.0007	,,	,,	,,	1,024	,,

To continue the analogy, this is like giving the height of hills from different datum levels on the same map. Therefore, it has been internationally agreed that the standard loudness level to which decibels in electro-acoustics are referred should be the loudness of a sound of 1,000 cycles, causing an average sound pressure of 1 dyne per square centimeter on the tympanum. Some of the authors calculate in positive decibels above and negative decibels below this level, *e.g.* −10 decibels means a sound 10 times, −20 decibels one 100 times *less* intense, +33 decibels a sound 2,000 times *more* intense than the reference tone (log 2,000 being 3.3).

In Germany, to avoid the calculation in negative decibels, and also to obtain results comparable with the figures obtained by aural methods, it has been agreed that the loudness of the above standard tone should be called *70 phons*, which is very nearly its loudness in decibels above the threshold of hearing. The zero level to which phons are referred corresponds to a sound pressure of

$$P_0 = 10^{-3.5} \quad \text{dyne/cm}^2.$$

* B.R.S. Bulletin No. 14. Now out of print.

† *Silencing a Noisy World* and catalogue of the Noise Abatement Exhibition. Published by the Anti-Noise League, August 1935, 6d.

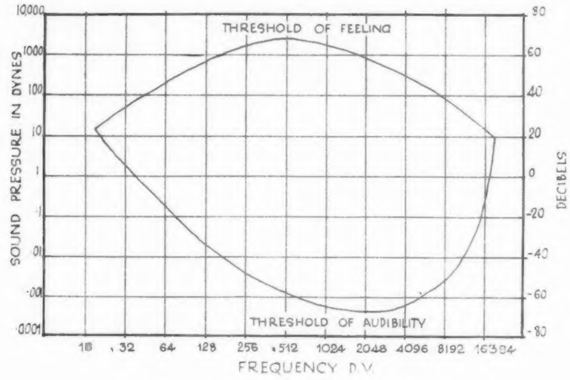


Fig. 1—The range of audibility

The essential difference between the decibel and the phon is that when calculating in decibels we have to state the reference level, whereas the phon is a decibel referred to the average sound pressure of $10^{-3.5}$ dyne/cm^2. This has been found very convenient by physicists, and therefore the use of the phon is spreading.

In comparing two sounds *of the same frequency*, either decibel or phon can be used. It is the same to say "a sound is louder than another by 20 decibels or by 20 phons," or, again, to say "the loudness reduction of a partition is 38 decibels or 38 phons." But phon and decibel are not the same unit if the decibel is referred to the threshold of audibility, other than for the frequency 1,000. *E.g.*, a sound of 70 phons loudness corresponds to a loudness of 35 decibels above threshold at 128, and of 48 decibels above threshold at 256 cycles, the threshold being at a much higher sound pressure at low pitches than at 1,000 cycles.

In architectural sound insulation, which is concerned with human nerves, the human standard, *i.e.*, the threshold of audibility, is to be preferred. Sound meters may be obtained which are weighted, by a system of adjusted resistances, to imitate the human ear. But not everybody can think easily in decibels. Few, perhaps, realise that decibels cannot be simply added or subtracted. Let us add a sound of 60 decibels "above threshold" (we shall omit this reference in future) to another sound of 60 decibels. The resultant loudness will not be 120 decibels, but 63 decibels only. Why? Sixty decibels correspond to an intensity of one million above threshold. The intensity of two such sounds is two million, and the logarithm of two million is 6.3.

Again, let us add a sound of 50 decibels to another of similar frequency and quality, but of 60 decibels loudness. The intensities are 100,000 and 1,000,000, respectively; the resultant intensity is 1,100,000, and its logarithm 6.04; the resultant loudness 60.4 decibels. As we cannot distinguish an increase of loudness less than one decibel, a sound of 60 decibels will not be appreciably louder if another sound of 50 decibels is added. While this last example explains the *masking effect* of loud noise, it also points out the greatest difficulty of sound insulation, *i.e.*, the fact that *by materially reducing the intensity, the loudness is but slightly reduced. E.g.*, if the intensity of a noise of 70 decibels (10,000,000 intensity units) is reduced by 50 per cent., the loudness is not reduced to 35 decibels, but to 67 decibels only (the logarithm of 5,000,000 being 6.7).

The Disturbing Effect of Noise

In some countries, experts dealing with noise nuisance measure the loudness of disturbing noise as compared with a standard limit of loudness which can be tolerated. Unfortunately, no such standard exists, and noise nuisance cases are started, as a rule, by nervous people being less tolerant than the expert's sound-meter. The disturbing effect of a noise depends not only on its loudness, but also on its pitch, quality (musical or raucous), duration, repetition, unexpectedness, etc. The nervous state of the person disturbed, and the quality of his work, are also important factors.‡ Thus the author cannot conceive any measurable standard of a disturbing limit of loudness. It is unfortunate for the efficiency of sound insulation that the masking effect of a louder noise described above does not apply to sounds of a conspicuous quality, which can be heard out of a louder complex noise, even if they be less loud by 15-20 decibels. A joke with an underlying truth comes into the author's mind: The manipulator of a steam hammer asked the workman at his side to "stop that darn tapping with your fingers at the work-bench." An analysis of a complex noise may reveal the most disturbing frequencies against which it is necessary to take special measures.

The Vibration Nuisance

Much less is known and written on *palpable vibration* than on *audible noise*, though the effects of vibration are none the less deleterious. When crossing to America, tourist-class, the author himself experienced the disturbance caused by steady vibration, day and night, strong enough to make a good handwriting impossible. His journey from Budapest to London and back by aeroplane was, despite the beauties of the trip, a tremendous nervous strain owing to the drowning noise of the engine and to the high frequency vibration, to which he is very sensitive.

Professor Reiher, of the Stuttgart Technical University, carried out a series of experiments with rattling platforms, of which he could regulate the frequency and amplitude. Apart from individual sensitiveness, an average amplitude and frequency limit could be

‡ The author's own small children are very noisy—they feel bigger when shouting. He is not disturbed while designing a façade or an ornament, but cannot concentrate on writing a scientific paper in noisy surroundings. Not being a tyrannical father, he prefers to write at night.

found above which most people suffer headache, sea-sickness or other nervous disturbance (Fig. 2).

Buildings may be severely attacked directly by traffic and machine vibration, as well as indirectly by the settling of the soil compacted by vibration, a few examples of which will be given later.

Heat Insulation versus Sound Insulation

Heat and sound insulation are frequently connected in the public mind owing to the fact that some materials (*e.g.*, cork) are excellent insulators against cold and are also used with advantage for sound or vibration insulation. This is absolutely erroneous. The principles of heat insulation are quite different from those of sound insulation, and so are their technical methods. Our sensitiveness to heat or cold is much less than to sound ; it is non-logarithmic and to a certain degree self-adjusting. Thus heat insulation does not require the same detailed care as sound insulation, where small fractions of non-insulated sound may spoil the entire effect of insulation. It can also be said that while there are heat-insulating materials, no complete sound-insulating material exists. It is the construction which insulates, by proper choice of materials. The same material may insulate against sound or not according to a right or wrong use ; also the same material or construction may be an excellent insulator against air-borne sound and a good conductor of solid-borne sound.

Technical Methods of Noise and Vibration Reduction

Noise reduction has, as was shown at the Anti-Noise Conference, legal, as well as medical and educational aspects, but above all it is a technical problem. Most of the noise we fight against is caused by technical devices, and can be reduced by technical means. There are three possible methods of noise reduction :—

A. Avoiding the noisy site or the source of noise within a building.

B. Reducing the noise at its source.

C. Interrupting all possible paths of sound propagation : if there remains one only, then the insulation is useless.

Avoiding Noise by Avoiding Noisy Sites

The author, investigating noisy sites in various towns, found that land and building value is reduced by noise to such an extent that he is still wondering why proprietors, a potent class under the existing social system, do not start a crusade against noise. In 1932, when visiting America, it struck the author that in New York the great avenues with " Subway " traffic are all lined with skyscrapers, business houses, hotels and apartments, while the avenues with the very noisy, rattling " Elevated " are almost undeveloped : there are but old houses (two to three storeys) occupied by the poor and the lower class of immigrants. In Berlin he saw quite recently not single flats, but a row of four- and five-storey tenement houses facing the exceedingly noisy elevated railway, quite empty, and abandoned by tenants. In Budapest the migration of the population from the noisy city towards the quiet suburbs is a matter for real concern to both house-owners and authorities, including the municipal electric, gas and water works. In the last ten years about 200,000 people—that is, 20 per cent. of the population—abandoned their flats in town and moved into quieter quarters, although flats in town are cheaper and the time and money spent daily in travelling to and from town is considerable.

These few examples give sufficient proof of the close connection between town planning and noise abatement. It is the town planner's task to secure quiet residential areas between busy thoroughfares.

In Budapest the westward trend of the residential district overgrew an existing dairy plant, where, in order to supply milk early in the morning, milk cans were delivered, handled, washed from 2 a.m. Neighbours could not sleep, the banging of empty cans was audible in the quiet night within a quarter of a mile. Legally, although the Hungarian Anti-Noise Regulation is very severe, the noise could only be reduced, but not entirely stopped, as the dairy plant had a permit of operation still running. This permit will not be renewed, but meanwhile the flats in the surroundings lose at least half of their rental value.

Another case worth mentioning is a Budapest street leading uphill, lined with apartment houses in demand for their quietness. Unfortunately a summer restaurant on top of the hill, enjoying a lovely view, became fashionable, and now it is almost impossible to sleep with windows open in rooms facing the street. The speeding of cars uphill in second gear, the changing of gears and the braking are much more noisy than horn hooting, which is now prohibited in Budapest.

Small courts in flats and hotels with reflecting surfaces

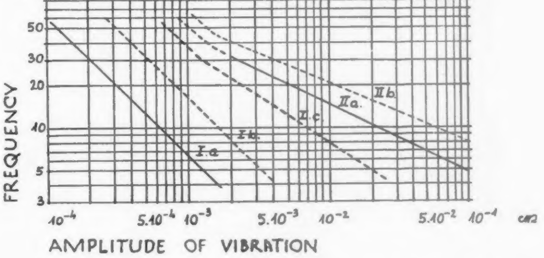


Fig. 2. Sensitiveness of humans to vibration. I slight, Ib medium, Ic strong, IIa sea-sickness

may be very noisy. The author once took a room facing the courtyard in one of Berlin's best hotels in the hope of enjoying a quiet night's rest. He overlooked the fact that the kitchen and beer cellar opened to the same courtyard, and there was a banging and rolling of casks day and night. Also the type of narrow courts common with cheaper tenement houses all over Central Europe is very noisy. One single loudspeaker at an open window fills the house with " music."

The B.R.S. Bulletin on the reduction of noise does well to recommend the quietness of " the roof floor above the cornice, set well back behind a solid parapet." But in steel or reinforced concrete frame buildings the top floor—protected from street noise—suffers the maximum of vibration. In another well-known hotel in Berlin, opposite a railway station, the author had the same feeling in his mansard room as in the steerage of the ocean liner : street and railway traffic, the shaking of the laundry machines working on the same floor, set the mansard into vibration which was easily felt, and also heard, by the rattling of any loose object. The table lamp was slowly moving along the writing desk, glasses were rattling, etc. Lower floors, where the weight of the walls and floors above prevented free vibration, were better from that point of view. Most important is the quiet siting of bedrooms and living rooms within the house. In one case an architect prepared a most unfortunate plan with sanitary fittings fixed on the partition wall between two flats on each floor, so that noises from the toilets were audible in the neighbour's dining-room. One of the tenants who rented a flat for three years abandoned it after a few weeks. The Budapest Court decided that the tenant had full right to abandon the flat and to recover damages, as the owner did not communicate to him the existence of disturbing noises before he took the flat.

In a public building the soil pipe of the lavatories upstairs was encased in a chase covered with thin plaster on wire netting, running in the main wall of the committee room. The room had to be vacated because of the disturbing noise. As to other planning factors, the author could not do better than to refer to Mr. Bagenal's paper on " Noise and Housing," published in the August, 1935, issue of this journal.

Reducing Noise at its Source

The reduction of noise at the source is the safest and most successful means of noise abatement. Once the noise is generated it is difficult to prevent its propagation through thin partitions, light floors, along all the piping and wiring which connects the rooms of a modern house. To save space, we shall enumerate the various sources of noise without much explanatory text.

Impact Noises

(i) The most disturbing noise of *footsteps* (Fig. 3) is primarily caused by the impact of a hard shoe on a hard floor, reinforced in many cases by the resonance of floor cavities. A secondary noise is often caused, with floors not stiff enough, by deflection under the weight of footsteps. This is revealed by the rattling of furniture, drinking glasses, etc. In such cases the best sound insulation cannot make up for the lack of rigidity. Insulation against footsteps is, as a rule, unsatisfactory. It is hardly possible completely to cut off every connection between floor and wall. In the " silenced " house of the Anti-Noise Exhibition footsteps were audible in spite of the noise caused by visitors. Reducing the noise of footsteps at the origin is, on the other hand, easy. Rubber, felt or cork shoe-soles, rubber or cork flooring, thick carpets or carpets laid on elastic fibre boards, cork-linoleum floors materially reduce the impact of footsteps.

(ii) *Pushing chairs* along wood or stone flooring causes most irritating noises. Carpets, felt discs or polished metallic buttons fixed under the chair-legs prevent the generation of these noises.

(iii) *Banging doors* are especially bad in reverberant rooms, as well as in thin partitions, which vibrate as a membrane. Wooden door frames often produce a rather musical tone, while steel frames give a sharp click.

In one case which the author investigated, a tenant complained against the noise caused by the grille of the entrance door to the house. Her bedroom was close to the door, and although the wall was 20 ins. thick the sharp impact of steel door on steel frame gave her a shock every time the door was shut at night. Perhaps the noise was reinforced by the wood panelling under the windows. An automatic closing device and felt lining in the door frame improved matters. If a rubber or felt strip were a standard fixture of door frames, noise in houses would be reduced considerably and partitions would suffer less. Silent, rubber-cushioned doors were shown at the Anti-Noise Exhibition.

(iv) *Rattling glass panes*. In Continental practice glass panes of doors and furniture are, as a rule, not set in putty or rubber strips, but fixed by wood battens. Banging such doors is accompanied by the rattling of glass. Also traffic vibrations are readily registered by loose glass panes. A thin coat of putty on both sides of the glass along the frames makes such doors much quieter.

(v) *Sheet-zinc or galvanised iron roofs* and copings are very noisy in rain, more so in hail. The thin metal sheet, bulging out between the fixed points, acts like a drum. The author experienced this noise in an inexpensive Italian hotel offering various acoustical defects worth studying. The doors were of 1-in. soft wood, the stairs creaked, the partition between his room and the next was a studded wall with nothing but reed and plaster on the studs. But after the first

drops of rain the arguing of the lady next door with her husband was no more audible, so deafening was the noise of rain on the tin roof. Also such *loose parts* as blinds, external rolling blinds, louvres, loose copper flashings, signboards, etc., are very noisy in wind.

Installation Noises

(i) *Noises in the water supply* form a problem of their own. A few years ago the Municipality of Berlin built a student's home where the noise of washtables was so irritating that students could neither work nor sleep. Whenever a tap was opened there was a hammering and howling all over the house, until the wash-basins were entirely removed. This experience was followed by a competition for the best book on the prevention of water supply noises, and prizes to the value of 2,000 marks were given. Water supply noises are mostly caused by loose valve discs, pushed back by water pressure, rebounding by elasticity, and generating a noise which can resemble a machine-gun.§

In a big apartment house, on one occasion, the author had to find the valve which made an intolerable noise. All taps were closed and then one after the other opened and shut again. It soon became evident that all taps supplied by one of the rising mains caused noise, so that the source of the noise was assumed to be the sectional valve of that main. This proved to be the case ; the sectional valve had been connected in the wrong direction, against the flow of the water as indicated by an arrow. In another case a ball-valve, as used on the Continent for flushing tanks of W.C.s, was hammering at night when the water pressure was high, alarming all the inhabitants of the house. It was found that the ball was not sufficiently immersed in water when it should have closed the valve, so that the valve was opened by water pressure. The opening pushed the ball deeper into the water, which shut the water off and the ball rebounded. Water-hammer is often caused by sudden closing of taps or by the operation of piston-pumps.||

Much noise is caused in water pipes by sudden changes of direction or sectional area. Dr. F. Michel's photographs show the eddies formed at such points, and also show the bubbles of air released at points of pressure reduction. Mengeringhausen designed stream-line valves to reduce eddies and frictional noises. His book " Correct Plumbing " contains a wealth of good hints on various problems of sanitary installation, including noise reduction.

(ii) *Noises of central heating.* The buzzing and singing of hot-water boilers is caused by the rough cast-iron surface forming minute pockets into which the circulating water does not enter. Steam bubbles are generated, suddenly absorbed by the water, and new steam bubbles formed. This sets the boiler into a high-frequency vibration. Linseed oil, burned on to the surface, fills the pores and reduces the buzz. Another nasty noise, occurring in steam-heating plants, is caused by steam entering the return pipe and being suddenly absorbed by the condensed water. This makes a gurgling noise, and the series of shocks given to the water causes hammering noises. The fault is, as a rule, either in design, workmanship or in the maintenance of the heating system : return pipes are too narrow, clogged with rust or dirt, check valves not in working condition, there are water-sacks in the return pipe, etc.

Fig. 3—Returning the footsteps (Judge 1930)

There are also noises not generated in the heating system proper, but in connection with it. In a case investigated by the author, the president of a bank, a very nervous gentleman, was awakened every morning at 5.30 by the noise caused by stoking, shovelling of coals, and the cleaning of grates, readily conveyed to his room by the piping. He asked for " absolute soundproofing," which could not be guaranteed. Nevertheless, the solution of his problem was easy : the

§ In England it is found that rubber washers to pressure taps tend to cause water hammer : often rubber washers have to be replaced by leather.

|| This tends to happen more at night owing to the fact that in daytime open taps provide more relief to the stress in pipes set up by the pump.

boiler was enlarged by a few sections, so that, when properly fired in the evening, it kept the house warm till 10 a.m. next day, so that no stoking was necessary early in the morning.

Complaints have often arisen against the hum of centrifugal pumps and their driving motors in forced-circulation hot-water heating plants. Motors of low speed and sturdy construction, and belt-driven pumps on separate foundations, cause less noise. Also the velocity of hot water should not be as high as to cause a hiss at branches, bends and valves, often experienced with steam heating.

Machine Noise

It is safe to say that *a noisy machine is a poor machine*. Most machine noise is generated by the impacts of loosely fitted parts or by vibration due to unbalanced forces. Thus noise is reducing the efficiency and the life of the machine, causing unnecessary stresses and wear and tear in the material. It is not the architect's task to design better machines, but it is his duty, in the interest of his client, to fight for them and to reject noisy machines.

(i) *Lifts*. It is a little cheaper for the engineer to place the machine-room of lifts above the shaft, as less cable and no guiding wheels are necessary, also there is less wear on the cable. Acoustically, it is safer to have the machine room in the cellar, where it is, as a rule, possible to build machine foundations independent of the foundations of the building. The author has investigated many cases in which cheap lift machines on the top floor caused noise and vibration which the tenants could not tolerate. In one house a very light, undersized, one-phase A.C. motor, mounted on very light I beams, shook the whole house at every start to such an extent that the starting of the lift motor could be felt by the hand on the external balcony railings where the noise was masked by street noise. In that case the machine had to be shifted to the cellar, where a special machine-house was built with walls and ceiling not touching the walls of the building. D.C. and three-phase A.C. motors cause less noise, but it is possible to manufacture nearly silent one-phase A.C. motors, too. The author wishes to express his full appreciation of the motors he saw at the Anti-Noise Exhibition, which were really silent, much more so than any similar machine he had seen previously on the Continent.

(ii) *Ventilator fans* are another source of noise in our buildings. Much more is known now about ventilator noise than was known before laboratories investigated the problem of silencing aeroplanes. It is possible to build noiseless fans, but unless this is to be the standard condition of delivery, cheap competition will always try to sell the noisy kind. High-speed motors and fans are smaller and cheaper than low-speed ones ; also high-speed air circulation requires ducts of smaller section, and the resonant galvanised iron ducts are cheaper than massive ducts of brickwork or concrete.

The results of attempts at reform so far are not gratifying. In one of the finest museums in America the author asked whether there was a mechanical workshop downstairs, and was told that there was only a ventilating plant. Furthermore, in the Pergamon Museum in Berlin, with highly reverberant floors, walls and skylights, his trained ears seemed to detect the noise of a gigantic concrete-mixer working at the extension then in progress. To his disappointment it was again only a fan operating the forced hot-air heating.

Architects and engineers could easily come to an agreement as to the tolerable limit of machine noise, including household machinery, and the highly developed science of mechanical engineering could then satisfy the standards set without exceptional difficulties or expense. The principal points to consider are :—

1. Low and uniform speed.
2. Revolving and not reciprocating motion, where possible.
3. Balanced forces : (a 6-cylinder motor causes less vibration than a 2-cylinder one of same rating).
4. Heavy mass of the static parts, light mass of the moving parts.
5. Elastic supporting of moving parts.
6. Ample bearings and good lubrication.
7. Cogwheels and other parts, causing impact noises, should run in oil or be non-metallic.

It is worth mentioning that the Society of German Engineers has appointed a special committee to investigate cogwheel noises.

Noise in Offices and Public Buildings

Noisy typewriters cannot now be entirely discarded as the noiseless machines do not write as many clear copies as the old noisy types. Calculating, accounting, money-counting and cash-registering machines are far too noisy. Sufficient thought is not given them with this in view. Telephoning, dictating, conversation with clients, footsteps, rattling of paper make up the rest of the usual office noise. In department stores, the banging of lift doors, the rattling of escalators, the offering of goods, and sometimes even radio performances, increase the confusion of office noise. Restaurants are very noisy in southern and eastern countries, where people carry on loud conversations and handle their forks and knives carelessly.

All this noise cannot be stopped at the source : one cannot ask every client to talk quietly, nor expect every office to buy new silent equipment. Nevertheless, the reduction of that kind of noise is possible by ample use of *sound-absorbing materials*. Theoretically, the reduction is very slight. By absorbing half of the sound energy

at, say, 60 decibels noise level the remaining noise level will still amount to 57 decibels. But as the higher frequencies are more readily absorbed the noise loses much of its irritating components. That is why employees working in deadened rooms feel more acoustical comfort than should be theoretically expected. Also, hearing conditions being better in such rooms, people do talk more quietly and less noise is generated.

Under heading C, " interrupting all possible paths," there must fall the practical problems of sound insulation.

Air-borne Sound

Air-borne sound is mostly transmitted through cracks, holes or by thin walls acting like membranes. Our sensitiveness against sound being logarithmic, it is useless to install excellent sound insulation if there is a weak spot where noise can enter, *e.g.*, a window. Let us consider an example :—

The outside wall of a room has a surface of 120 sq. ft. and the window 30 sq. ft. If the average sound reduction of the 15-in. brick wall be 55 decibels, and that of the single window 25 decibels, what will be the loudness of the street noise coming through the wall, with a noise level of 70 decibels outside ?

Omitting the influence of reverberation inside the room and transmission losses to adjacent rooms, the energy coming through will be :—

$$\frac{120\times10^7}{10^{5.5}}+\frac{30\times10^7}{10^{2.5}}=9{,}538\times10^5 \text{ units.}$$

This, divided by the surface of 150 units, gives 6,350 energy units per surface unit, and as *log* 6,350 is 3.8, this means 38 decibels loudness. Thus, although 80 per cent. of the total wall area had a reduction factor of 55 decibels, the resulting reduction is but $70 - 38 = 32$ decibels. This calculation, as well as experience, shows that outside walls with single windows seldom can have a noise-reducing factor more than 35 decibels, and walls with double windows seldom more than one of 40 decibels, irrespective of the thickness of the wall.

The effect of cracks or openings is still more disadvantageous. Assuming that the windows of the previous example are not entirely shut, and there is an opening of 1 sq. ft., the reducing factor of the wall will sink to 21.3 decibels. Thus it is futile to fight against street noise in a room when windows do not shut hermetically. In the Chicago Loop, with the noisy " Elevated," a certain office could not be rented until sealed double windows and artificial ventilation were installed.

Partitions, single or double, cannot well insulate against air-borne sound if there is a shrinkage crack along the floor or ceiling, or if there is a door—padded or unpadded—with a wide joint to facilitate the opening of the door. Even key-holes spoil the sound insulation. Sound-insulating doors should not only be heavy, but also must fit tightly, with a rubber or felt stop in the frame and good caulking between the frame and the wall.

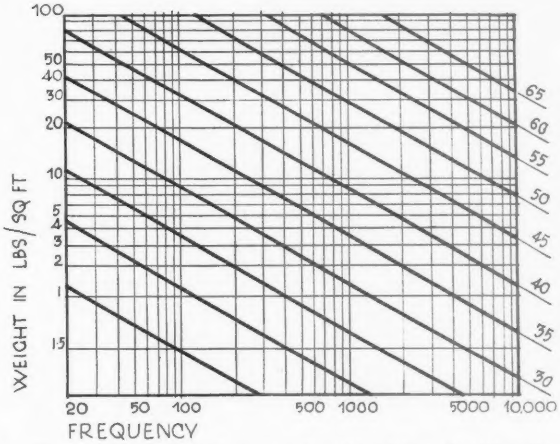


Fig. 4—Dr. Berger's diagram. Sound insulation of solid walls

Supposing that the partition is airtight, its insulative value increases with the logarithm of the weight per unit surface and with the frequency of the test tone. This is shown in Dr. R. Berger's diagram, transformed into British units by the author (Fig. 4). The diagram does not consider the effect of resonance : every partition has its self-frequencies at which it insulates less (Fig. 5).

It is obvious that, since the insulating factor increases only with the logarithm of the unit weight, it is not economic to try to obtain a high degree of insulation by increasing the thickness of a wall above a certain limit. Multiple walls are used in that case with advantage. But there is a world of difference between double partitions forming two independent walls of an acoustical laboratory and the same double wall as built in practice, resting on a continuous floor, connected by pipes, picture hooks, and sometimes also by mortar squeezed out of the joints. Therefore, although theoretically an air space between two walls is the best insulator (ignoring cases of resonance as described by Dr. Constable, of the N.P.L.), the author tried repeatedly, since 1928, such walls, and found that, in practice, they insulate much less than the same wall

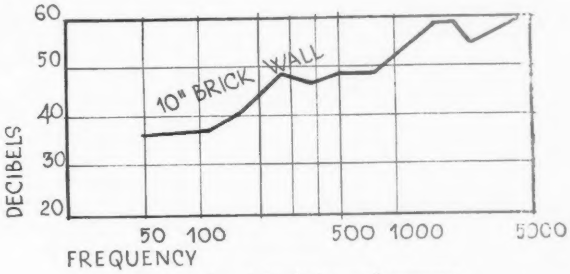


Fig. 5.—Sound insulation and resonance

built with cavity filled. The filling should be either a loosely tamped granular or fibrous absorbent (diatomaceous earth, cotton waste) or a loosely inserted elastic and absorbing fibre board or felt.

In his own buildings the author specifies a double partition resting on 1½-in. soft cork, with two layers of a fibrous board inside, not fixed to any of the walls; along the main walls the partition is sunk into chases lined with the same board; at the ceiling there is again a strip of cork, and the cove at the ceiling is made of canvas and plaster of Paris. One of the walls is of gypsum slabs, the other of burnt bricks, so that they should not have the same self-frequency. This type of wall is not too heavy, not expensive, and satisfactory if not spoiled by nails driven through. What nails can do is illustrated by a case M. Lyon—the designer of the famous Salle Pleyel—relates in his lectures on acoustics. He had to insulate a young composer's room, the resident underneath not tolerating the artist's piano performances. He put several layers of his special acoustical felt under the floor. The result was nil. "Take up the floor, there must be nails going through the insulation," he said. They found and extracted the long nails, re-laid the floor, without any appreciable improvement. M. Lyon was furious. "Tear up that floor again," he commanded, "there must be at least one long nail left!" They found that *one* long nail, took it out, and the insulation was all right.

Structure-borne Sound and Vibration

Not much can be said on successful insulation of structure-borne sound. Theoretically, and in laboratories, wonderful performance may be achieved by soft cork or rubber sponge put under the vibrometer. But how can one insert rubber sponge into steel stanchions or reinforced concrete columns? How can one disconnect continuous girders or multiple frames by a soft and elastic material? A certain reduction of the transmission along structures is possible by combining structural and insulative measures. Omitting the highly developed theory, we shall quote a few practical examples.

Stanchions and columns may be insulated against traffic vibrations by spreading the footings so that the stress on the foundation shall not exceed the stress permissible for cork. Steam hammers, drop hammers and similar machines should have very wide and heavy foundations to reduce soil pressure, with several layers of cork or felt, cellular rubber, etc., inserted between the upper and lower foundation block. A trench should entirely separate such foundations from foundations, walls and floors, of the building.

Machines or shafting should not be fixed to party walls. A separate wall should be built for that purpose, not touching the party wall.

Floors subject to impact noises should "float" on granulated cork, rubber chippings or elastic fibre boards. They must not touch the walls, otherwise the insulation is useless.

Pipes may be repeatedly disconnected by pieces of rubber hose; ventilating ducts by canvas tubes. The hooks holding pipes may be inserted into rubber or cork blocks. Motors are insulated from pumps if the latter are not directly coupled, but belt-driven.

The cases the author investigated show that heavy brick buildings, although they are somewhat better than frame structures, are not free from structure-borne noise.

Vibration nuisance is now in the foreground of scientific research on the Continent. In 1923 already complaints had arisen in France against street traffic causing cracks and traffic vibration had been measured. In Budapest and smaller Hungarian towns quite a number of cases came to the author's knowledge where old walls and vaulted ceilings cracked, and although repeatedly repaired the cracks opened again when heavy lorries or omnibuses drove by. In Vienna the chief municipal engineer, Dr. R. Tillmann, has got a set of seismographs to record vibrations in buildings. The curves drawn by his instruments allow the calculation of the stress-peaks, so that he can decide whether the vibration measured impairs the safety of the building. In Munich traffic vibrations compacted the sandy alluvial soil to such an extent that cracks due to settlement caused—according to municipal engineers—a damage estimated at six million marks in the last ten years. A typical vibration case was communicated to the author by Prof. Terzaghi, the famous soil specialist, and Dr. Tillmann. When building one of the huge Viennese municipal houses they had a rattling concrete mixer on one end of the building. Settlements have been measured in certain intervals, and it has been found that the walls adjacent to that machine, although the foundations were uniformly loaded, settled 1 inch more than the walls at the other end. Similar cases moved the German engineers to create a special laboratory at Berlin University for studying soil physics by vibration, and, although the work of the new institute has only recently started, the results are most promising. On recommendation of one of the laboratory's experts, the Shell House in Berlin has been surrounded by a retaining wall and airspace, to protect the building and its subsoil from traffic vibration.

In conclusion, sound insulation is a difficult *métier*, calling for theoretical and practical knowledge, as well as for the most conscientious observation of the smallest detail in design and workmanship. A systematical survey requires a book none too thin. One of the lessons experience in sound insulation tells us is that *better buildings and better machines are wanted and must be constructed*. It is the architect and not the speculative builder who will erect these better houses and order the better machines. Architects ought to have a feeling for sound insulation—its means quality.

THE ARCHITECT AND HOUSING BY THE SPECULATIVE BUILDER

ARTICLE V

Sunnyfields Estate, Mill Hill

THE ARCHITECTURAL ASSOCIATION COMPETITION IN CONJUNCTION WITH MESSRS. JOHN LAING & SON

This competition was an experiment that had two aims. The first was to interest the architectural profession, and the younger members of it in particular, in studying the somewhat peculiar requirements of building for direct sale and in designing for it. The second was to discover what contribution architects could make to a branch of building with which they have hitherto been little concerned and to demonstrate that contribution to the speculative builder.

Hitherto architects and speculative builders have regarded one another with what may be described as mutual contempt. It is not necessary here to dilate on the reasons for this or on the results of it ; both are well known, particularly to readers of the previous articles in this series. The aim is to remedy it. Closer co-operation between the two parties would obviously be of advantage to both and, what is more important, to the country generally. Therefore the organisation of this experiment—however the reader may regard the result—is a matter for congratulation and thanks to the A.A. and to Messrs. John Laing & Son.

The competition has already been illustrated and reviewed in the *Architectural Association Journal* for December 1935. Mr. John Laing contributes an article on " The Point of View of the Builder," and there is a corresponding (anonymous) article on " The Point of View of the Architect." The illustrations and comments here given are therefore somewhat in the nature of a review of a review.

Briefly, the history of the project is as follows. As a result of a conference on a scale of charges (now adopted and published) held between architects and speculative builders, Mr. John Laing offered one of his development estates as the basis of an architectural competition. The Architectural Association undertook to organise the competition, which was held in 1933. Messrs. John Laing and Son employed Mr. A. W. Kenyon [*F.*] and Mr. T. Alwyn Lloyd [*F.*] to lay out the estate. Houses were erected to the designs of the winners, Mr. Geddes Hyslop [*A.*], Mr. Philip B. Herbert [*A.*], and Miss Frances Barker [*A.*], and also to those of Mr. Kenyon and Mr. Alwyn Lloyd.

The first thing perhaps that strikes a visitor to the Sunnyfields Estate is that the scheme has unity. Most competitions for type houses, where the winning designs have been executed on adjacent plots, have ended in the creation of a very unhappy looking ensemble. This unity at Sunnyfields is clearly the creation of the consultants. Not only are the bricks and tiles harmonious throughout, but skilful placing of the different types and the linking of them together with screen fencing have given the scheme a composed appearance quite different from that of the ordinary speculative building scheme. This is only to be expected from two architects with extensive garden city experience.

In his article Mr. Laing indicates that the houses have not sold so well as the usual type built by his firm, namely, the semi-detached villa built to variants of the " universal plan." It should be realised, however, that this is not a matter of elevations. The usual houses by this firm are commendably free from fussy, applied detail and therefore the question whether the house-buying public like or do not like fussy ornament, such as sham half-timber, hardly arises. The matter is narrowed down to the fact that the architect-planned house is apparently not liked so much by this class of public as is the universally-planned house of villa type. Moreover, it appears that architects must make a still closer study of the requirements in building for sale than they have done in this competition.

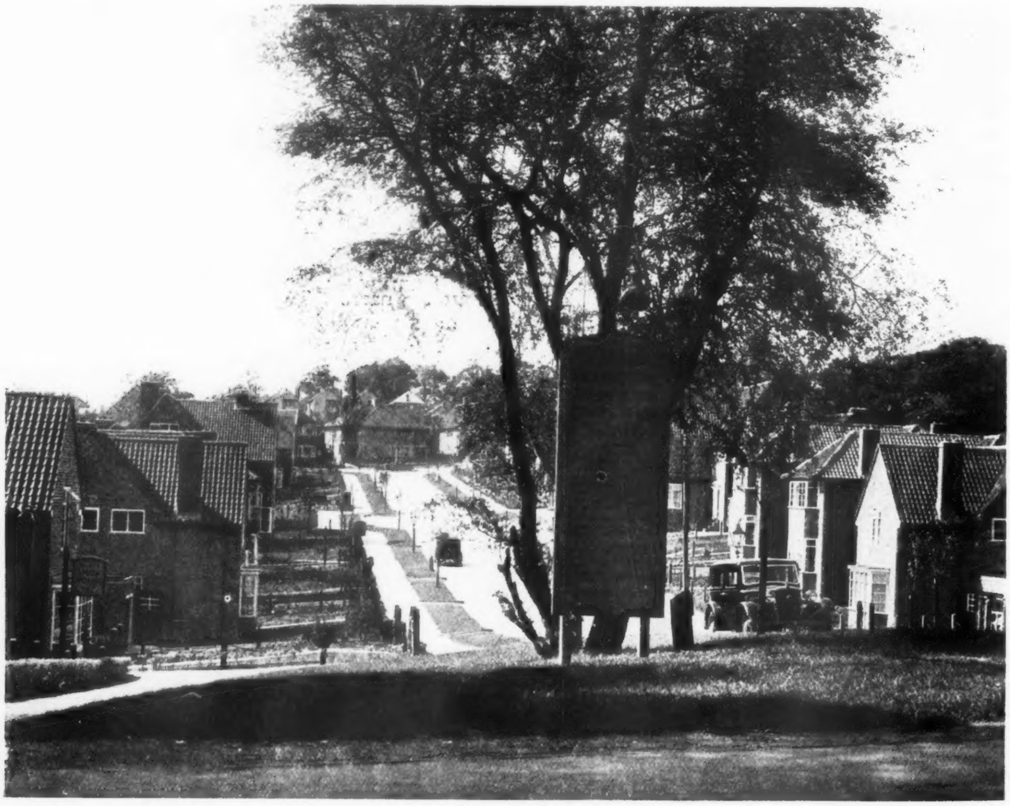
Mr. Laing, writing in the *A.A. Journal*, courteously puts the blame on the taste of the British public. This taste is certainly low ; but, nevertheless, it must be admitted that the public can be relied on generally to choose the house which has the best qualities of habitability and that they would buy something better than the universally planned villa if it were offered them.

It should be noted that Messrs. John Laing & Son have been careful to free this point from the Mill Hill environment by building some of these designs in schemes elsewhere, associated with their usual types. Mr. Laing says : " Although we made the price practically the same for the same floor area, yet we found that 75 per cent. of the public chose the usual type. We, therefore, conclude . . . that it is only an educated minority who prefer the more individual, architect's house."

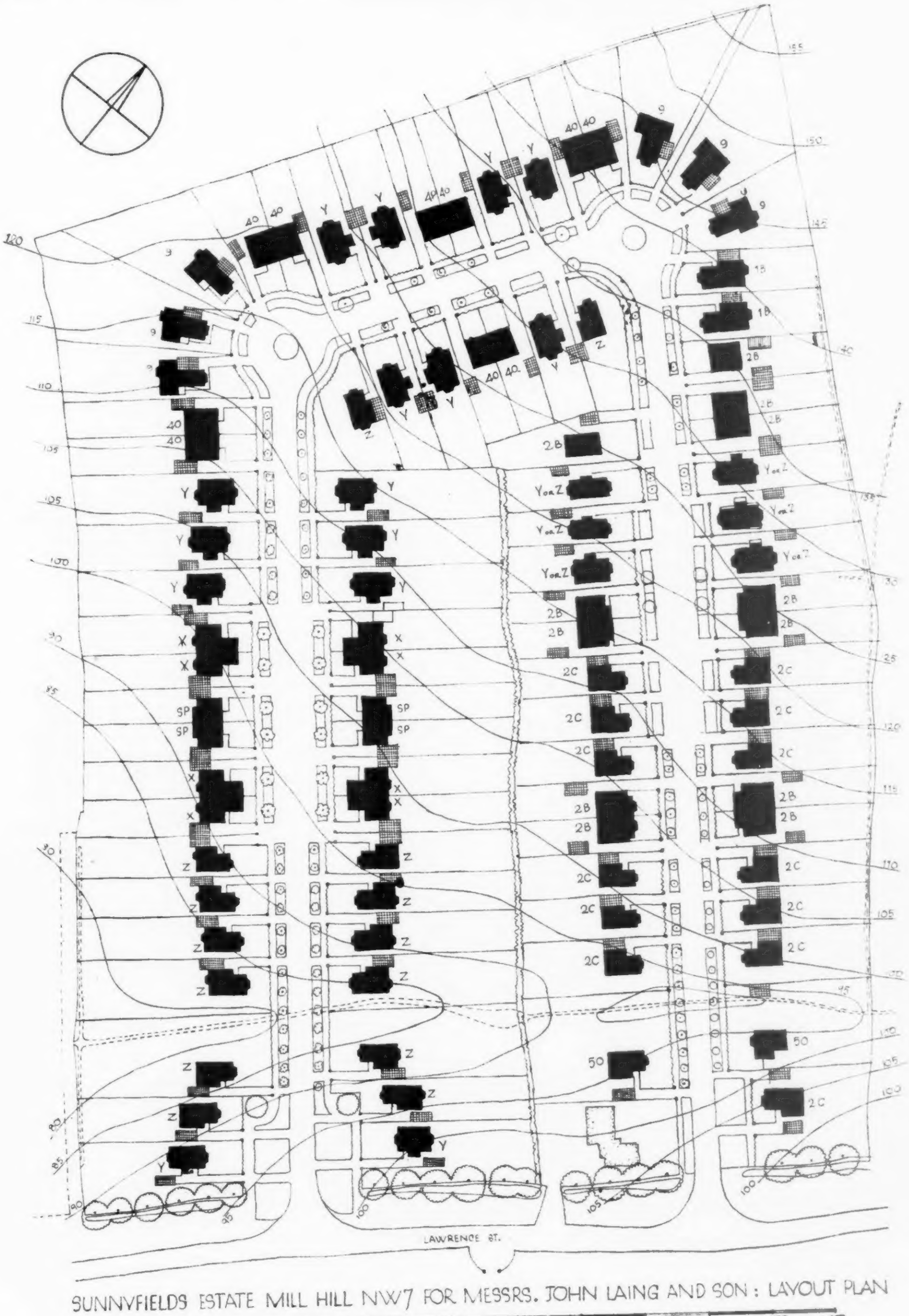
Nevertheless, Mr. Laing appears to regard failure as only comparative as his firm are developing a second estate on similar lines, and that they hope always to have several small estates where architect-designed houses will be used exclusively.

It may not be out of place to sum up here the points affecting this problem that have been outlined in previous articles in this series. The problem may be described as that of designing for direct sale, houses at £600 to £1,200. *Appearance:* detail does not much matter provided the exterior is dignified and looks its value. *Type:* the typical purchaser is villa-minded and does not want something that can be mistaken for a rural cottage or a municipal house; also he does not usually like a house that appears to him bizarre (which may mean too much in advance of its time). *Equipment:* this is all-important. The wife finally decides what house is bought and the finish and equipment must be studied to meet her household requirements in detail. It is worth noting here that the houses designed by Miss Frances Barker sold more rapidly than those by the men architects. The designer must not plan a house to accord with theories as to what he thinks should be the way of life of twentieth century man, but to fit the way in which the potential purchaser actually does live. *Structure:* The probable cost of maintenance is always envisaged by a purchaser. He fears stucco as possibly hiding bad brickwork (which it sometimes does) and certainly requiring more maintenance than a facing-brick wall. The facing bricks should be red or brown; stocks by the average man are regrettably regarded as "common bricks." Windows must be large and preferably casements. The usual architect-designed "Georgian" house with sash windows is a notorious bad seller.

These opinions are generalisations and probably temporary. That ideas and demands are changing—as Mr. Laing says—cannot be doubted. An indication of this change is the experience of a builder in connection with some reinforced concrete speculative houses which can, without offence to the architect who designed them, be described as ultra-modern.



A general view of the estate from the main road



SUNNYFIELDS ESTATE MILL HILL NW7 FOR MESSRS. JOHN LAING AND SON : LAYOUT PLAN

A pair of houses by Miss Frances Barker [*A.*]

The builder found that his week-end, curious visitors were divided into two camps. The young people as a rule liked and were even enthusiastic about the houses; elderly people execrated them. It must, however, be remembered that the builder will wish to appeal to the largest possible public and not to a limited section of it. He, therefore, has to aim at an average.

It is not necessary to describe the designs in detail, this has already been done in the *A.A. Journal*. Some general notes on materials and finish are desirable. The bricks throughout are a pleasant reddish brown and the tiles match them. The windows are painted white and the doors in bright colours. In some of the houses by Miss Barker, the horizontal pointing of the brickwork has been emphasised and the vertical pointing coloured to match the bricks. With cavity walls built in stretching bond this seems to look better than ordinary pointing. The grass verges and front gardens have been well laid out and planted, posts and chains being used instead of fencing.

The photographs illustrating this article are by Eric Jarrett [*A.*]. *Previous articles in this series were published on 24 February 1934, 28 April 1934, 23 June 1934, 4 January 1936.*

A group of houses by A. W. Kenyon [*F.*]

REVIEW OF CONSTRUCTION AND MATERIALS

This series is compiled from all sources contributing technical information of use to architects. These sources are principally the many research bodies, both official and industrial, individual experts and the R.I.B.A. Science Standing Committee. Every effort is made to ensure that the information given shall be as accurate and authoritative as possible.

Questions are invited from readers on matters covered by this section; they should be addressed to the Technical Editor.

The following are addresses and telephone numbers which are likely to be of use to those members seeking technical information. There are many other bodies dealing with specialised branches of research whose addresses can be obtained from the Technical Editor. We would remind readers that these bodies exist for the service of Architects and the Building Industry and are always pleased to answer enquiries.

The Director, The Building Research Station, Garston, Nr. Watford, Herts. Telegrams: "Research Phone Watford." Office hours, 9.30 to 5.30. Saturdays 9 to 12.30.

The Director, The Forest Products Research Laboratory, Princes Risborough, Bucks. Telephone: Princes Risborough 101. Telegrams: "Timberlab Princes Risborough." Office hours, 9.15 to 5.30. Saturdays 9.15 to 12.

The Director, The British Standards Institution, 28 Victoria Street, London, S.W.1. Telephone: Victoria 3127 and 3128. Telegrams: "Standards Sowest London." Office hours, 9.30 to 5. Saturdays 9.30 to 12.30.

The Technical Manager, The Building Centre Ltd., 158 New Bond Street, London, W.1. Telephone: Regent 2701, 2705. Office hours, 10 to 6. Saturdays 10 to 1.

RADIO RECEPTION IN FLATS

It is a common complaint among dwellers in the new blocks of flats that have taken the place of houses in built-up areas that reception of broadcasting in them is bad The wireless signals are subject to interference from neighbouring electrical apparatus, owing to the relative proximity of the latter and the inability of the listener to erect an efficient aerial in a position remote from the field of interference. The British Broadcasting Corporation, therefore, approached the Royal Institute of British Architects with a view to discovering whether certain steps could be taken to remedy this state of affairs. The matter was investigated by the Science Standing Committee of the R.I.B.A., and their report, which has the approval of the British Broadcasting Corporation, is given below.

INTRODUCTION

Broadcasting as a public service has become almost equally a part of everyday life as lighting, heating, water and similar services. It has been the practice in the past for most public services to be incorporated by the architect in the fabric of a house, with the exception of broadcasting service. The householder has been left to provide his own radio equipment, and he can quite well be left to do this.

Building owners and their architects have very frequently assumed that the flat-dweller may also be left to instal his own radio equipment, not realizing that the large block of flats presents difficulties which are generally absent from the individual house. It has become very common for tenants in large blocks of flats to complain of difficulty in using ordinary broadcast receivers, radio gramophones, and the like, whether they are of the portable variety or run from the mains or from a battery supply. The problem of ensuring good reception in flats and similar buildings has exercised the radio industry for some considerable period, and much time and research have gone to its solution. The present position, through research in several directions, is that most technical difficulties have been solved and that several kinds of efficient equipment have for some time been available.

Research has shown, however, that the most practicable results are obtained by treating the block of flats as a whole and not by leaving each tenant with the difficult task of solving his own radio problems—frequently to the discomfort of other tenants. Briefly, this means that the responsibility for ensuring good reception now rests with the building owner and his architect, rather than with the radio engineer. And it is the architect who in most cases will have to carry the blame for the lack of means for good reception.

FAULTY RECEPTION

There are two main causes of poor or faulty reception on the radio sets tenants may themselves purchase and instal in flats. One is peculiar to buildings containing a large amount of steelwork (steel or reinforced concrete framed buildings, monolithic reinforced concrete buildings and brick buildings with reinforced concrete floors carried with or without a central spine of beams and stanchions), and the other is general to all large buildings, framed or otherwise, which have electrical equipment :—

(*a*) The metallic frame or reinforcement of the structure acts as a screen diminishing the strength of required broadcasting signals received on sets working on any of the types of indoor aerial. (Tenants are usually prohibited by the landlord from fixing a number of efficient outdoor aerials, for obvious reasons.)

(*b*) The electrical plant and domestic apparatus (lifts, refrigerators, automatic telephones, vacuum cleaners, fans, hair-driers, etc.) commonly fitted in large blocks of flats usually cause severe interference with reception, particularly if they are operated close to the indoor receiving aerial on the receiving set.

ALTERNATIVES FOR GOOD RECEPTION

It becomes incumbent, therefore, upon the architect, first, to ensure that serious interference from all electrical apparatus in the building or on the site is suppressed as much as possible, and, secondly, to advise the building owner as to the best method of ensuring that his tenants may enjoy reasonable radio reception.

It is important that the block of flats be treated as a whole, for both technical and economic reasons. Two main systems

of equipment are available and it appears to be the duty of the architect to examine each system and to advise his client as to the most appropriate for each particular building. Each has advantages and disadvantages, and the choice of one or the other depends as much upon the type of flat and tenant involved as upon economic and technical considerations. The main alternative systems available are :—

(1) The High-Frequency System : which provides an efficient aerial-earth system to each flat, leaving the tenant free to purchase and connect up his own radio receiving set.

(2) The Low-Frequency System : which provides a loud-speaker (or a plug point for one) in each flat, fed by a relay system of broadcast reception with or without one or more alternative programmes.

THE HIGH-FREQUENCY SYSTEM

It is possible to operate up to five or six radio receivers of the usual type from one single-wire highly efficient aerial fixed high above a building, or otherwise away from sources of interference or screening, and provided with specially screened down-leads. An improvement on this simple installation is to provide a transmission-line connection instead of the screened down-leads.

Technically, a small installation of this sort would consist of an isolated aerial terminating in a small weatherproof high-frequency transformer, in turn connected to the building by means of a transmission line (a twin lead-covered cable, properly earthed, which, not being a part of the aerial, may be plastered over or otherwise concealed), with branch lines in parallel taken to the five or six receivers capable of using this system, each of which would be fitted with a small matched high-frequency transformer.

The high-frequency system for a large number of flats consists in the provision (by the building owner) of a normal sized efficient aerial on the roof, or other isolated position outside the steel-frame, a transmission line to a high-frequency distribution amplifier (size about 20 in. by 16 in. by 12 in.), designed to give sufficient power to operate the required number of sets, and specially screened and segregated wiring to each flat. The tenant is then provided with a plug point into which he can connect the aerial and earth terminals of his receiver, which, of course, he provides himself. A plug for this purpose is available which also includes the mains plug which will be required by the tenant's receiver.

This system, properly designed and installed, overcomes the weakening of signal strength by the steelwork in the building and also overcomes to a large extent the serious problem of interference by electrical apparatus. Its success depends first on the proper placing of the common aerial. This may be on the roof well outside the field of interference of any lift machinery, adjoining aerials, or other apparatus, and it may be so placed as to be out of view from the street. Alternately it may be right away from the building, in a distant part of a large site, where it may be masked from view by trees or other means, and connected to the building by an underground, or otherwise concealed, transmission line. Secondly, the success of the system depends upon the proper continuity and extremely careful earthing of the transmission line and of its branches to the various flats. These should be supported for their entire length and great care taken that they are not kinked, crushed, stretched or damaged in any way. Where joints are necessary it is essential to see that the wires are properly soldered, that the insulations are re-established and that the lead coverings are re-joined with bare wire to ensure proper continuity.

The cost of this system varies principally in relation to the aerial position and amount of initial transmission line required. In average circumstances the cost for 100 flats would be from £75 to £100 for the installation up to and including the distribution amplifier, plus about £2 a point for the wiring to each flat. This means a total cost of £275 to £300 for installing one point in each of 100 flats, or £3 a flat. The amplifier uses about 70 watts, valve replacement is negligible, and a time switch may be installed to cut in and out the system at any pre-determined times. Maintenance costs, therefore, are exceedingly small. These prices are for A.C. supply. With D.C. a rotary converter will be necessary.

It will be seen that the chief advantage of this system is the freedom it gives tenants to purchase and use a radio set which meets their individual requirements so far as number of stations to be received is concerned. There is, however, nothing to stop one tenant installing so powerful a set that its use would be a nuisance to other tenants. Even with a time switch, a powerful set could still keep working, emitting with the programme the maximum amount of interference noises. Weaker sets would, of course, have their output considerably reduced, if not made entirely inoperative, when the time switch cuts out the aerial-earth system. Some clause in the lease limiting the output of individual sets would, therefore, seem desirable when the high-frequency system is adopted.

THE LOW-FREQUENCY SYSTEM

This system is also known as the Relay system, and as the Audio-Frequency Re-distribution system. In its simple form, the system consists of a properly isolated aerial leading to a central communal receiving set from which loud-speaker points are served. In principle the system provides a service of broadcasting to tenants very much as hot water and central heating are commonly provided—to be turned on at will. Most hospitals have now a service of this sort, but generally supplying a large number of headphones rather than loud-speakers.

There are two main types of low-frequency distribution, one with the central receiver on the premises and directly controlled by the building owner, and the other with the central receiver in some outside premises, controlled by a relay services company who undertake to supply a radio service to the flats.

In the first type the building owner must set up an efficient aerial (as described for the high-frequency system) and connect it by ordinary down-lead to an adjacent receiving set and amplifier of suitable size or by transmission line to the set if it is to be housed in some part of the building, though it is naturally best to choose a position which is as much outside fields of interference as possible. A distribution system is then necessary, somewhat similar to that required for electric light, but carried out in specially insulated, screened cable with the screening earthed. The system should be divided into feeder groups with junction boxes and switches, each floor possibly forming a group. Should a short circuit be caused by, say, a defective loud-speaker flex, this grouping will obviate a prolonged failure of the whole installation and enable the fault to be quickly located. In each flat, of course, there will be a loud-speaker and a volume control. This may be provided by the building owner, or he may provide merely a plug into which tenants may connect their own loud-speakers and a volume control—in which case tenants

should be allowed to purchase only loud-speakers suitable for the relay installation.

The system described above gives one programme of broadcast to tenants. It is usual for any relay system to give two, three or four alternative programmes, and there are instances of an even greater number being installed. The inclusion of alternative programmes is a simple matter, but it should be borne in mind that each programme requires a separate installation, set, amplifier and distribution system of wiring. The loud-speakers are not, of course, duplicated ; a change-over switch takes care of the alternative programmes in each flat.

It is the principal disadvantage of this system that tenants have to take the programme or programmes given them. Three alternative programmes appear to be popular—the National and Regional broadcasts of the B.B.C. and one foreign programme. The actual number to be installed would depend to some extent on the type of flats and tenants under consideration.

There are corresponding advantages—the maximum loudness of the loudspeaker is directly under the control of the building owner, the placing of the loud-speakers (especially when built-in) can be arranged to minimise any annoyance from one flat to another, and by the inclusion of a time switch the hours of loud-speaker operation in the entire building can be controlled or limited according to local conditions or needs.

The cost of the central apparatus for this type of low-frequency installation, to provide 100 flats with one programme, is approximately £200. For two programmes the cost would be £400. Such a set would have a total output of 60 watts, allowing 0.6 watts per loud-speaker if all 100 tenants were listening-in to the same programme simultaneously. (A 100-watt set would cost about £300.) The wiring to loud-speaker points would cost about £2 per point, so that the complete installation of a 60-watt set to 100 flats would be approximately £400 for one programme (£4 a flat) or £800 for two programmes (£8 a flat). These figures are necessarily only approximate, and would vary in relation to the plan of the building, the number of floors and the number of flats to be served.

Maintenance and labour charges would be almost negligible, since the set would be worked automatically from the electric mains and would be cut in and out with time switches when broadcasting starts and finishes, or otherwise as desired.

The second type of low-frequency, or relay, system may be preferable in certain circumstances. It is exactly the same in principle to the type just described, except that the central receiving set is away from the building and is frequently owned by an outside company. Land lines bring the relays to the flats building, where the service is dispensed through distribution systems of wiring to the various flats. In very large buildings an amplifier is often installed in the flats building to ensure the necessary output.

The cost of this type of system may be considerably less than the previous systems described. Many relay companies will undertake the complete installation and wiring at a nominal charge, or even free of charge, under the supervision of the architect, provided they are allowed to collect a weekly rental from the tenants. This weekly charge is approximately 1s. 6d. per point for a two-programme relay, 2s. for three programmes and 2s. 6d. for four programmes, exclusive of a hire charge of from 6d. to 2s. for a loud-speaker, if these are not built in. Many of the relay companies offer tenants other services, such as electric clocks, special console loud-speakers, gramophone-playing tables, and soon, each for a weekly hire charge. These charges may be collected direct from the tenants or they may be paid by the building owner, who would recover the cost, possibly at a profit, through slight increases in rent.

TELEVISION

For any complete system of radio equipment it should be remembered that a reasonably perfected television broadcast will eventually be available. It may be some years before television becomes popular enough to warrant the installation of relay systems to distribute it, but before this it is probable that aerial-earth points for television in flats may be demanded.

Television reception requires two distribution systems, one for sound and one for vision. For a low-frequency distribution system the wiring now suitable for radio reception would be suitable for the distribution of the aural half of a television service, but would not be suitable for the visual part. Furthermore, the aural part of the television service will *not* replace the present aural service on medium and long waves. If, therefore, the installation of television service is considered for some future date, it is desirable that the special circuits be included in a new building now, or at the least that conduits to take the wiring should be built in, to avoid subsequent damage to the premises.

REGULATIONS

The Institution of Electrical Engineers now include in their "Regulations for the Electrical Equipment of Buildings" (formerly the I.E.E. wiring rules) a special section (Section 9) dealing with the safety requirements of radio installations. In the same publication, Regulation 401 (B) lays down that radio distribution wiring shall not be run in the same tube, groove or section of conduit or casing as the cables or wires for lighting, heating and power circuits unless it conforms as regards size, protection and screening of conductors with the requirements of these other circuits. Regulations 612 (A), 615 (A), and 202 also relate to circuits used for radio distribution.

LICENCES

Whatever system or radio equipment is installed, it should be clearly understood that every tenant must take out a 10s. receiving licence. In addition, it will be necessary for the building owner to obtain permission for the installation of a wireless "exchange" from the Postmaster General. It is unlikely that this permission will be withheld or that any obstacle will be placed in the way. The Post Office will probably require a periodical return from the landlords of the names of the tenants served, and in obstinate cases assistance in extracting the 10s. licence.

LEGISLATION

In connection with the whole question of radio reception in flats it should be remembered that many countries have legislation to prevent or limit electrical interference with broadcast signals. It seems desirable that in this country efforts should be made by the parties concerned, namely, the General Post Office, the British Broadcasting Corporation, the electrical industry and the architectural profession, to devise means of overcoming existing difficulties, either by legislation or by other means. The Institution of Electrical Engineers set up a representative committee some time ago to consider fully and report on this question. In the meantime, these notes are written to bring to the notice of architects the

important question of, and the means now available to ensure, the reception of radio in flats.

ACKNOWLEDGMENTS

The foregoing Report was drafted by Mr. L. W. Thornton-White, A.R.I.B.A., Hon. Secretary of the R.I.B.A. Science Standing Committee. He has asked us to acknowledge the help he has received from the Engineering Department of the British Broadcasting Corporation, the Radio Department of the General Post Office, the Radio Manufacturers' Association, and, in particular, from Mr. M. A. Bulloch, of Messrs. Standard Telephones & Cables, Ltd.

The British Broadcasting Corporation have also supplied a typewritten copy of an article, translated from German, entitled "Broadcast Reception and Community Aerials," by Erich Boker, Hamburg. This appeared in a German publication, "Archiv Für Funkrecht." The copy has been placed in the reference section of the R.I.B.A. Library.

MEASUREMENT OF DAYLIGHT

The National Physical Laboratory have just published some interesting figures* on the intensities of daylight illumination throughout the year. It is obvious that average figures are required over a long period so as to allow for variations in sky conditions. The measurements have been made over a period of ten years and give even curves throughout the year. They were taken at 9 a.m., noon and 3 p.m. in four octants of the sky, north, south, east and west. From this report it is possible to tell what the average light intensity at a window will be for any aspect at any time of the year. It is noted that the figure of 500 foot candles seems a satisfactory minimum standard for general dull weather between 9 a.m. and 3 p.m. This confirms an assumption made in a previous report.

The report is mainly concerned with daylight, exclusive of direct sunlight. Some measurements for solar illumination have been made over a shorter period and are included. The graph given shows that the intensity of direct solar illumination, normal to the rays, may be as high as 7,500 foot candles.

Generally the measurements reveal some interesting facts. For example, the light from the whole sky is about eight times as great at 9 a.m. on a June or July morning as on a January morning. The average June noon is four to five times as bright as a December or January noon, and at 3 p.m. the illumination is nearly ten times as great in June as in December. In January the average illumination in foot candles from the whole sky is 405 at 9 a.m., 850 at noon and 390 at 3 p.m.

* *Seasonal Variation of Daylight Illumination.* Illumination Research Technical Paper No. 17. H.M. Stationery Office. Price 4d.

The report contains the results of measurements made at Teddington, but measurements in other localities are being initiated, while more detailed results are expected from the use of a recorder employing a photoelectric cell which is now being used in the work. Nevertheless, the present results should be of immediate use to architects in considering daylight problems.

THE SIZE OF LETTER BOXES

We have received from the Postmaster-General a letter from which the following is an extract :—

"The desirability of providing street-door letter boxes or apertures in all premises is a matter which is, no doubt, fully appreciated by the members of your Institute, but the attention of the Post Office has been drawn to the fact that the apertures are frequently too small—particularly in residential premises. From experience it has been found that, generally, the most satisfactory size is 8 inches by $1\frac{3}{4}$ inches."

This pronouncement indicates a small but useful piece of standardisation work, and one which might possibly come within the scope of the British Standards Institution. In any case, the dimensions should be borne in mind by architects when selecting ironmongery. The letter does not, however, indicate the corresponding undesirability of making the aperture too large, large enough in fact to admit the arm of the pilferer or even of the burglar who wishes to get at the inside knob of the night latch. Keeping to the narrower dimension of $1\frac{3}{4}$ inches should prevent this.

OMNIBUS GARAGES

What may be regarded as a useful appendix to Mr. F. O. Baddiley's article on the design and construction of omnibus garages, published in the JOURNAL of 21 December, is a publication by the Society of Motor Manufacturers and Traders. This is a schedule of particulars of all types of motor vehicles. It is in two parts entitled respectively, "Schedule of Private Car Specifications and Prices," and "Schedule of Commercial Vehicle Specifications and Prices, including Agricultural Tractors," Each part is sold at 2s. 6d. and is obtainable from the S.M.M.T., Ltd., Statistical Dept., 83 Pall Mall, S.W.1. Copies are in the reference section of the R.I.B.A. Library.

The particulars cover all types of vehicles, including fire engines, taxicabs, goods and passenger vehicles, factory and works trucks, ambulances, trolleybuses, mobile cranes, and shovels. For each vehicle, apart from engineering particulars, such facts are given as weight, dimensions, ground clearance, turning circle, etc., which will be of use to architects in planning.

Town Planning and Housing Progress: Extracts from Annual Report of the Ministry of Health for 1934-5*

Extracts from the main report for the year 1934-35 dealing with Housing and Town and Country Planning have again been issued as a separate publication.

The Minister of Health prefaces his Report to the King with a brief summary of some of the main developments in Housing and Town Planning during the reign.

We take leave, without permission, but we hope agreement, to refer to the report backwards, dealing with Planning first.

Over fifteen out of the thirty-seven million acres of England and Wales are involved in some stage of a town-planning scheme. When we consider that the first planning scheme by a local authority only came into operation in 1913, that the War intervened, and that the landowners (whose interests are vitally concerned) have had to be educated to accept as a matter of course the principles of good planning, splendid progress can fairly be claimed. The Minister states finally :—

> "The stage is thus set for the accomplishment in years to come of a task of great magnitude, which in its widest aspects concerns the general welfare and the aesthetic satisfaction not so much of the present as of future generations."

Let us hope that this may prove to be only a careful statement, and that those of this generation will indeed not work solely for posterity.

Model Clauses

One of the most important events of the town-planning year was the issue of the Model Clauses based on provisional ones for use in the actual drafting of schemes.

Members will bear in mind Mr. P. J. Waldram's observations in this JOURNAL on the suggestion made therein for the preservation of light and air to buildings.

Statistics of Allocation of Land in Approved Preliminary Statements and Schemes

A comparison of the year's allocation of land for different purposes is made with the figures for the preceding five years. The outstanding changes are a welcome increase from 11.9 per cent. to 27 per cent. in the scheduling of private open spaces and agricultural or other open belts, and a decrease of land zoned for residential purposes at 12 to the acre of from 30.4 per cent. to 14.6 per cent. This decrease is, however, accounted for by considerable proposals during the year covering rural areas where lower densities are appropriate, and does not necessarily mean that a lack of normal housing land at 12 to the acre is indicated.

The Planning of the South Downs

This exceedingly interesting matter is dealt with at some length. The present position is recorded, the issue between the authorities broadly outlined and indications given as to a possible course of action.

The Green Belt Round London

Details are given of the London County Council's proposed grant of £2,000,000 during the next three years towards the purchase or statutory preservation from building of some 113 square miles of land comprised in a continuous belt approximately 13 miles from Charing Cross.

The actual sites are not worked out in detail, but probably include 10,000 acres of existing public open spaces. This proposal of the Greater London Regional Planning Committee evolved during the period in which it was advised by Sir Raymond Unwin.

Garden Cities and Satellite Towns

The Report of Lord Marley's Committee on this vitally important subject is not commented upon, except to note that two out of thirteen members signed subject to a reservation and two others presented dissenting reports. There is obviously much more spade work to be done. There is, indeed, a sad division of opinion amongst our own members. It seems to us that sufficient stress is not laid on the fact that there is room for various methods. Let us make haste, if necessary, slowly, insisting on say ten new towns instead of 100.

Time Limits and Propaganda

Planning authorities are advised to gauge the amount of work to be done, and to gather round them sufficient skilled staff to ensure compliance with the time limits required under the regulations.

The successful results obtained by some planning authorities who have issued leaflets to developers at various stages, explaining the objects aimed at and how they can be assisted, are again commended, coupled with the suggestion that when the scheme comes into operation a further simple statement of its nature and scope of positive application should be issued. This is obviously sound advice, and action on these lines would be appreciated by many who find it hard to keep in touch with local affairs in other ways.

Notes on Appeals

The appeals to the Minister against decisions of local authorities are classified, and some of particular interest are stated at length.

Progress of Planning

Statistics for the year under review are given and compared with the averages for the previous five years.

Housing Policy

The housing policy of the present National Government is clearly stated, and the proposed provisions of the new Housing Bill (now the Housing Act, 1935) outlined. It consists, as is now well known, of—

(*a*) the abatement of present and prevention of future overcrowding by the provision of the necessary new dwellings. Overcrowding beyond a defined standard is now an offence ;

(*b*) the demolition of insanitary dwellings, which is made the subject of an intensive campaign, and the amendment of the law to remove certain possible hardships under the previous statutory provisions, and the provision of the necessary rehousing accommodation ;

(*c*) the provision of any further working-class housing apart from that arriving out of action under (*a*) and (*b*).

The five memoranda issued by the Ministry of Health and referred to in our issue for 23 November are invaluable aids to an understanding of the new Act, and particularly memorandum *c*, which deals with the provision for re-development areas. This provision should enable great strides to be made in the proper re-allocation of town-planning

* H.M.S.O., 1*s*.

factors where at present in chaotic condition. It is in this connection that local architects should put themselves in a position to advise with authority by a careful study of local conditions.

As to (*b*), interesting statistics are given of action under the Housing Act, 1930, in connection with clearance, compulsory purchase orders, and the closing of individual houses, and the amount of rehousing provided.

In connection with (*c*) the case for the abolition of the 1924 Act subsidy is stated, and it is argued that the results on private enterprise building have amply justified the action. Nevertheless, the Minister agreed to the raising of loans by 250 authorities to cover the costs incurred in erecting 12,702 houses without Exchequer assistance, including a large number of dwellings for aged persons.

Sizes of Houses

The Minister still advises that normal family cottages should be of the non-parlour type, and have about 760 sq. ft. of floor area, but points out that a limited number of parlour type houses have been agreed in special cases.

General House Building Situation

The figures of assisted and non-assisted dwellings and their average cost are brought up to date and special reference made to some low cost tenements of " the cottage or cottage type "

Rural Housing

A special reference is made to the welcome increase in the amount of work done with the special assistance available under the Housing (Rural Workers) Acts, whose operations have now been extended to June, 1938.

The new Housing Act amended the provisions of these Acts slightly and every possible encouragement is given by the Minister to this side of the work. The total number of dwellings for which assistance has been granted has now risen to 8,234 at the date of this report.

Small Dwellings Acquisition Acts and Section 92 of the Housing Act, 1925

The proposal here outlined to restrict the advances to houses of a lower value has since become statutory.

Housing Associations

The above is the new name for bodies such as Public Utility Societies, Housing Companies and Trusts, whose constitution or rules allow of low rates of interest only. Their work is reviewed, and a forecast of the endeavour to increase their work by further legislative power is given.

Management and Allocation of Accommodation

It is stated that more attention should be given to the management of the large blocks of property now in local authorities' hands. Community centres and recreational facilities should, where necessary, be provided on local housing estates.

London

Special reference is made to the position of London housing and the work of the London County Council and the Metropolitan Borough Councils.

Housing Finance

Up-to-date figures are given of the Exchequer contributions, the capital expenditure and rates of interest during the year, and under the heading " Rents " the Ministry say they are only in possession of figures relating to the rents of the Addison Scheme houses, which at present range from 7s. 7¼d. to 13s. 4¾d. per week, exclusive of rates, the variation depending on situation and whether they are of parlour or non-parlour type.

Book Reviews

Mr. YERBURY'S PICTURES

One Hundred Photographs by F. R. Yerbury. *London: Jordan Gaskell. 1935. 18s.*

Mr. Yerbury's photographs hardly need " introduction " to the profession, which is all the more reason for us to welcome the excellent book which he has published containing his own selection of one hundred pictures of a characteristically wide range of subjects. If Mr. Yerbury had been a " new " photographer, each of whose pictures needed a commentary half a page long to explain its æsthetic significance, this review might, too, have to discourse about the theory of camera art, about the influence of photomontage and the place of photography in the development of the new expressionism, but this is not necessary, because they are just good pictures which explain themselves. Of course they do a lot more besides; they explain Mr. Yerbury, for instance. They explain, though that, too, is an old story, a very great deal of the A.A. school's eclecticism—the reason for the influence of Sweden in 19—, of Denmark in 19—, of Russia in 19—, because Mr. Yerbury has been by far the most successful traveller who year after year has brought back his " scoops " to delight and astonish us, and send our ideas all abroad.

These hundred pictures have among them many old favourites which most of us remember, not because we have had opportunities of seeing them often, but just because when we first saw them they meant a lot, and were fixed on our memories; because the vision which had been fixed by the photograph was coherent and vivid, and because first-rate technical ability had presented the vision in a direct unfussy way which didn't leave one puzzled why the photographer stood on his head to take that one, or how he managed to make a twenty-foot column look fifty feet. Among these—for the writer of the review, at least, other people will have their own—are the picture of Copenhagen police courts, with the attendant housing between the columns (No. 52); the Waterloo Bridge picture (No. 83); The Crystal Palace (No. 63); two pictures of Bloomsbury (Nos. 16 and 17), and many more.

The most successful are the most direct, which try to do no more than present ideally a natural view. This may not exploit the whole range of a camera's possibilities, which quite clearly can be used much more intensely as a means for direct non-representational art, but that—it just happens to be so—is not Mr. Yerbury's method.

The volume, which is excellently produced in the now almost standard form of books of photographs, is introduced by Mr. James Bone, and no one could have done it better. His lightness of touch and interest not merely in the view but in the component parts of it corresponds with Mr. Yerbury's own.

This is an excellent book to have.

SOPHIAN'S ANNOTATED HOUSING ACT, 1935

THE HOUSING ACT, 1935, *by T. J. Sophian. London. 1935. Pitman. 12s. 6d.*

Mr. T. J. Sophian's new book on the Housing Act, 1935, is written for persons engaged in the administration of the Housing Acts or others who may be concerned with the details and provisions of those Acts. Accordingly, it assumes a knowledge of previous housing law and sets out to show how the Act of 1935 has modified the earlier enactments and what new principles and provisions have been introduced.

The first part of the book is in the form of a commentary enabling the reader to grasp the principal changes which are effected. The second part sets out the new Act with notes on each section.

The book by its nature must be more useful to lawyers and to local authority officials than to architects, but the commentary would be valuable help to any architect who wanted to know just what the new Act was setting out to do. We have no criticisms to make on the commentary except that paragraph 2 dealing with over-crowding appears to us to fail to bring out the fact that the over-crowding standard applies to a house as a whole and not to individual rooms in a house, so that if a family has sufficient accommodation as a whole according to the standard it is no concern of anyone how they dispose themselves inside that accommodation.

THE STRENGTH OF MATERIALS

ELEMENTS OF STRENGTH OF MATERIALS, *by S. Timoshenko and G. H. MacCullough. MacMillan & Co. 1935. 14s. net.*

This substantial work of 350 pages and as many figures is the outcome of the senior author's two-volume book on the same subject and is compiled as a text-book for undergraduates in American colleges. The work therefore conforms to American methods and usages, and though this aspect has to be regarded by the English reader, the principles expounded are, of course, substantially the same in all engineering practice. It is mostly in the matter of concrete that our notation differs markedly from that used in America. To enable the student to test his knowledge a large number of problems are inserted in the various chapters and as islands of refuge for the beginner in a sea of calculations, fundamental formulæ are printed in a distinctive type. Graphic methods of solution, however, find considerable use. The work is divided into 13 chapters. Tension and compression, shear and torsion are first dealt with, followed by chapters on stresses and deflection due to simple and then complex forces; columns naturally are dealt with distinctively, there is an interesting chapter on energy of strain and, finally, one on the mechanical properties of materials, while the two appendices provide tabular and other data. The reviewer, as an architect, has not really felt himself competent to give an opinion on the merits of the work as an engineering treatise, and he has, therefore, obtained the benefit of a Consulting Engineer's opinion. This, while recognising that the book is written in a manner suited to the English reader, points out a few unusual expressions such as "the convex side of a beam" on page 231 for that part under strain. The recommendation that the student should learn to use a steel company's handbook is commended, while the problems and examples are described as practical and interesting. Chapters 7 and 10 on deflection of beams and complex stresses are specially commended for their valuable and practical information.

ALAN E. MUNBY [*F.*]

CHEMISTRY OF CEMENT AND CONCRETE

THE CHEMISTRY OF CEMENT AND CONCRETE, *by F. M. Lea and C. H. Disch. London: Edward Arnold. 1935. 25s.*

The authors in their introduction present this book as "a general survey . . . for the chemist and also for the engineer or architect." The first part of the book is likely chiefly to be of interest to the chemists, but the whole of the book, and the latter part in particular, has a good deal of practical information which the designer will find of use. The first chapter is a history of the calcareous cements; the next chapter is a classification of cements, brief descriptions of the characteristics of hydraulic cements; after this comes the central chemistry section of the book, containing a detailed study of the materials and processes of cement manufacture, cement compounds and their properties, hydration, setting and hardening action of acids and sulphate waters on cement, mechanical and physical properties, etc. etc. The four concluding chapters are concerned with concrete aggregates, the resistance of concrete to natural and other destructive agencies, and the examination of concrete failures.

URBAN DEVELOPMENT AND PRESERVATION

NOTES ON THE TREATMENT OF ANCIENT TOWNS, *by William Randolph. London. Heath Cranton. 1935. 1s.*

This is a short brilliantly written pamphlet—in the proper pamphleteer style. Mr. Randolph has a good case in saying that while we are becoming keenly alive to the call for rural preservation we are neglecting the equally pressing need for urban preservation; but he goes further, and by examples from Lincoln, Grantham, Derby, Peterborough, Nottingham, Chesterfield, Ely, Cambridge and Norwich, shows with great effect, though occasionally with some unreason, what miserable mistakes are being made (not merely allowed to happen) by people who, whether by reason of their claims to be called experts or their local ties and loyalties, should know better. The chief theme of the argument is that development in our towns proceeds without any sense of the fitness of things; incongruous juxtapositions, pompous "modern" buildings in the most expensive wrong materials, barbarous engineering structures unfeelingly dumped exactly where their ill effects on scene and amenity can be most felt, a prudish desire for clearance, e.g., of the old market which used to stand as the "tented field," the centre of urban life in Nottingham until the city built such a magnificent town hall that they had to call it by the genteel name of Municipal Buildings and clear off the market to make an "open space."

Mr. Randolph, by conveying his ideas keenly and tersely, has served his cause well. His is the sort of dogmatic utterance that should wake people up if only they read it, but perhaps they should discount some of the non-progressive purely revivalist parts. To leave things as they are or to go back to as they were is both impossible and undesirable.

INDIAN ARCHÆOLOGY

ANNUAL REPORT 1341-42F. (1931-33 AC) OF THE ARCHÆOLOGICAL DEPARTMENT OF HIS EXALTED HIGHNESS THE NIZAM OF HYDERABAD, *and* THE KANNADA INSCRIPTIONS OF KOPBAL, *by C. R. Krishnama Charlu. Published by the Nizam's Government. Baptist Press, Calcutta. 1933.*

The annual report, a well-printed and illustrated quarto volume, describes the conservation work during the year at Bidar, the Excavation of the Takht Mahall enclosure, the conservation of Hazrat Amir Hasan Sanjari's Dargah of early royal tombs at Gulbargah, and of temples at Ramappa and of other buildings elsewhere. The reports also describes and illustrates the beautiful mosque at Doranhalli and a mosque in the village of Karachur.

The second volume recorded above is of interest chiefly to students of Indian caligraphy.

Review of Periodicals

Attempt is made in this review to refer to the more important articles in all the journals received by the Library. None of the journals mentioned are in the Loan Library, but the Librarian will be pleased to give information about prices and where each journal can be obtained. Members can have photostat copies of particular articles made at their own cost on application to the Librarian.

SCHOOLS

WERK (ZURICH). *Vol. XXIII. No. 1. P. 19.*
Kindergarten and small children's schools at various places in Switzerland and Austria. All pleasant fresh looking buildings by R. Gaberel of Davos; Hans Leuzinger of Zurich; Reinhart, Ninck, Landolt of Winterthur, and Franz Singer of Vienna.

MUSEUMS

CASA BELLA (MILAN). *Vol. XIV. No. 95. P. 26.*
The Civil Museum, Bolzano. No plans, but some illustrations showing display.

AMERICAN ARCHITECT. *Vol. CXLVII. No. 2640. P. 16.*
Proposed children's museum in Brooklyn; a centre for juvenile education in history, science and art, with auditorium (Howe and Lescaze).

LIBRARIES

AMERICAN ARCHITECT. *Vol. CXLVII. No. 2640. P. 14.*
The Wilbour Library, Brooklyn Museum, New York, by Howe & Lescaze. A small Egyptology library cleverly constructed in unoccupied space in the museum; equipment and general design neat and modern.

KENTIKU SEKAI (TOKYO). *Vol. XXIX. No. 11. November.*
Tiba Library, Tiba City, by J. Watanabe. A medium sized public library.

BUILDER. *Vol. CL. No. 4849. P. 67.*
St. Hilda's College, Oxford. New library by Sir Edwin Cooper, designed in bays with full depth gallery over each bay.

CIVIC

BUILDER. *Vol. CL. No. 4848. 3 January. P. 17.*
Falkirk Municipal Offices competition. First premiated design by J. Inch Morrison [*F.*] and W. C. Laidlaw.

BUILDING. *Vol. XI. No. 1. P. 13.*
Public buildings in housing schemes. Article on relation of halls, car parks, shopping centres, cinemas, etc.

SWIMMING BATHS

BUILDER. *Vol. CL. No. 4848. 3 January. P. 15.*
Wycliffe College open-air swimming bath by K. M. B. Cross [*F.*]. 100 × 42 feet; 3 to 7 ft. 6 ins. deep.

BUILDER. *Vol. CL. No. 4849. P. 74.*
Open-air swimming pools and dressing rooms, Newton House Hotel, Londonderry, Yorks, by E. M. Lawson [*A.*]; and at the Three Arrows Hotel, Boroughbridge, Yorks.

ARCHITECTS' JOURNAL. *Vol. LXXXIII. No. 2137. 2 January. P. 39.*
Working detail of a private swimming bath at Hampstead, 45 × 17 feet, greatest depth 5 feet 6 ins.

SPORTS PAVILIONS

WERK (ZURICH). *Vol. XXIII. No. 1. January. P. 5.*
Ice rink pavilion, Davos. An interesting building with carefully designed heat insulation; includes dressing rooms, restaurants, administration offices, etc., and terraced seats.

BUILDER. *Vol. CL. No. 4849. P. 90.*
University College School Old Boys' Club sports pavilion. A reinforced concrete building with terraced seats under cantilevered roof, by B. L. Sutcliffe [*F.*] and H. C. Farmer [*A.*].

SHOPS

AMERICAN ARCHITECT. *Vol. CXLVII. No. 2640. P. 60.*
Store fronts and show windows. A useful reference article, well illustrated with check list of data for window planning.

RAILWAY BUILDINGS

BOUWBEDRIJF (HAGUE). *Vol. XII. No. 26. 27 December. P. 283.*
Railway signal boxes at Maastricht, Holland.

INDUSTRIAL

BUILDING (SYDNEY, N.S.W.).
Dairy Farmers' Co-operative Milk Co. building for milk treatment, Sydney.

HOSPITALS, ETC.

WERK (ZURICH). *Vol. XXIII. No. 1. January. P. 9.*
The Surgical Clinic, Zurcher Heilstätte Clavadel, Zurich. A building designed for sun and air treatment. All wards opening on to bed terraces.

BUILDER. *Vol. CL. No. 4849. P. 94.*
Extensions to Watford Joint Isolation Hospital, by W. H. Hobday [*F.*]. Single storey pavilions.

BULLETIN TECHNIQUE DE LA SUISSE ROMANDE. *Vol. LXII. 4 January. P. 7.*
Competition design for additions to Yverdon Infirmary.

KENTIKU SEKAI (TOKYO). *Vol. XXIX. No. 12. December.*
Saiseikai Prefectural Hospital, Osaka, by Y. Nakamura; also the Osaka Dental College Hospital.

CASA BELLA (MILAN). *Vol. XIV. No. 95. P. 10.*
Mothers' and children's clinic and crêche, Trieste, by U. Nordio.

THEATRES AND CINEMAS

MONATSCHEFTE F. BAUKUNST U. STADTEBAU. *Vol. XX. No. 1.*
Data sheet of sizes, etc., for auditorium seats for theatres, stadia, etc.—a very useful reference.

BATIR (BRUSSELS). *Vol. IV. No. 37. December. P. 464.*
"Rex" Cinema, Antwerp, by Léon Stynen. 1,500 seats.

DOMESTIC

ARCHITECTURAL REVIEW. *Vol. LXXIX. January. P. 25.*
House at Chipperfield, Bucks. An interesting small modern house in brick and timber; also houses at Wimbledon and Bagshot by E. Maxwell Fry [*A.*].

ARCHITECTS' JOURNAL. *Vol. LXXXIII. No. 2137. 2 January. P. 9.*
House at Chalfont St. Giles, Bucks, by Mendelsohn and Chermayeff [*F.*]; also flats at Uxbridge Road, Ealing, by Ernest Schaufelberg, and at Hall Green, Birmingham, by F. W. B. Yorke.

CONSTRUCTION MODERNE (PARIS). *Vol. LI. No. 13. 29 December. P. 274.*
Flats, Boulevard Victor, Paris, by P. Patout. An unusual scheme of studio flats.

ARKITEKTEN (COPENHAGEN). *Vol. XXXVII. No. 10. P. 151.*

Tenement building in Stockholm, by Sven Markelius; compactly planned small flats with communal nurseries, restaurants, etc.

BUILDER. *Vol. CL. No. 4849. P. 83.*

Dorset House, Marylebone Road, N.W., by T. P. Bennett [*F.*]. A huge block of flats with shops on street; 21 flats on first eight floors, and 17 on ninth, varying from one living, one bedroom to two living, four bedrooms. Rentals £165-£325. Also flats 88, 90, Portland Place, by Trehearne, Norman Preston and Co., and "Portland Gate" flats, Hove, Sussex, by Joseph Hill [*F.*].

MONATSHEFTE F. BAUKUNST U. STADTEBAU. *Vol. XX. No. 1.*

Beds, data sheet of sizes and plan arrangements for minimum sleeping quarters.

HOUSING

JOURNAL OF ROYAL SANITARY INSTITUTE. *Vol. LVI. No. 7.*

JOURNAL OF AUCTIONEERS' AND ESTATE AGENTS' INSTITUTE. *Vol. XVI. No. 1.*

Papers on the Housing Act, 1935, reflecting the opinions of experts in the spheres of the two Institutes.

HOTELS AND RESTAURANTS

ARCHITECTS' JOURNAL. *Vol. LXXXIII. No. 2138. 9 January. P. 25.*

Palace Court Hotel, Bournemouth, by A. J. Seal [*L.*] and partners. Hotel only on lower floors, flats above, shops on street, also (p. 60) houses in Hampstead Garden Suburb, by Brian Herbert [*A.*].

AMERICAN ARCHITECT. *Vol. CXLVII. No. 2640. P. 29.*

"The Bacardi Bar and Import Lounge," New York, by M. A. Sanders, and the Schenley wine cellar.

GENERAL BUILDING AND PLANNING DATA

AMERICAN ARCHITECT. *Vol. CXLVII. No. 2640. P. 75.*

Series of data sheets. Those in the present number include tables of mathematical data—properties of circles, circular sections, etc., etc.; also tables of the weights of materials and standard symbols for draughtsmen for materials and electrical equipment. A very useful reference.

MONATSHEFTE F. BAUKUNST U. STADTEBAU. *Vol. XX. No.1.*

Staircase and other landings.

Planning data and staircase planning details generally.

TOWN PLANNING

ARCHITECTURE (PARIS). *Vol. XLVIII. No. 12. P. 449.*

Town planning and architecture in Russia. A careful and comprehensive survey of modern Soviet work by Emile Maigrot based on reports and information gleaned at the C.P.I.A. Rome Conference: well illustrated.

JOURNAL OF INSTITUTE OF MUNICIPAL AND COUNTY ENGINEERS. *Vol. LXII. No. 14. P. 733.*

Town and country planning in relation to transport, by Thomas Adams [*F.*].

JOURNAL OF THE TOWN PLANNING INSTITUTE. *Vol. XXII. No. 2. P. 25.*

Planning in Essex. The practical adoption of recent legislation in connection with town and country planning and the restriction of ribbon development, by R. H. Buckley, County Surveyor. An "extremely stimulating and valuable paper," the fruit of practical experience.

MATERIALS

BUILDING. *Vol. XI. No. 1. P. 22.*

Reconstructed stone. Article on manufacture and use.

BAUMEISTER. *Vol. XXXIV. No. 1. January. Building Supplement.*

Useful article on the decay of external renderings and stucco on new buildings.

CONSTRUCTION

KENTIKU SEKAI (TOKYO). *Vol. XXIX. No. 11. November. P. 13.*

The execution of anti-earthquake construction, by Y. Sekine. Illustrated article.

STRUCTURAL ENGINEER. *Vol. XIV, n.s. No. 1. P. 18.*

Foundations of London structures. Paper read to I.S.E. by F. S. Snow. A thorough study with much useful technical information.

EQUIPMENT

JOURNAL OF INSTITUTE OF HEATING AND VENTILATING ENGINEERS. *Vol. III. No. 34. December.*

The warming of buildings by electrical thermal storage. Article by John Eden [*A.*].

HISTORICAL

ARCHITECTURAL REVIEW. *Vol. LXXIX. January. P. 33.*

Cuthbert Brodrick—biographical article by Dudley Harbron [*F.*].

GAZETTE DES BEAUX ARTS. *Period VI. Vol. XV. No. 873. P. 1.*

Romanesque architecture and sculpture in Denmark. Article by M. Bernard Fay. Illustrated.

Accessions to the Library

1935-1936—III *(continued)*

TOPOGRAPHY

BROWN (IVOR)

The Heart of England.

8½". viii + 120 pp. + pls. Lond.: Batsford. 1935. 7s. 6d. R.

HARTLEY (DOROTHY)

The Countryman's England.

8½". xii + 116 pp. Lond.: Batsford. 1935. 7s. 6d. R.

GOMME (*Sir* LAURENCE)

*London.

la. 8o. Lond. 1914. *Copy now in Loan Library. Presented by Mr. Allen Foxley* [*F.*].

GILL (THOMAS)

Vallis Eboracensis: comprising the history and antiquities of Easingwold and its neighbourhood.

8o. Lond. 1852. *Presented by Mr. Allen Foxley* [*F.*].

TOWN AND COUNTRY PLANNING

INTERNATIONAL FEDERATION FOR HOUSING AND TOWN PLANNING

International Congress of H— & T— P (14th), London, 1935.—*Part II. Report.

8¼". [Lond.] 1935. R.

ARKHITEKTURA S.S.S.R., *journal*

——. [Special issue.] Rekonstrukdiya Moskvi [reconstruction of Moscow]. 10-11 (Oct.-Nov.).

11½". Moscow. 1935.

UNION OF SOVIET ARCHITECTS

Moscow. General plan for the reconstruction of the City.—General'nii plan, *etc.* (*Text in English and Russian.*)

pam. 7¼". [Moscow.] 1935.

British Russian Gazette and Trade Outlook
——. (Vol. xi, No. 12, Sept. Containing The New Moscow, by Beatrice King.)
11″. Moscow. 1935.
—All presented by M. S. E. Tchernychev, architect, of Moscow.

Meston (Dougall)
The Restriction of Ribbon Development Act, 1935. *Incorporating* Ministry of Transport : Restriction of Ribbon Development Act. 1935. Memo. RRD.1. 1935. 1d.
9¾″. xxiv + 60 + 8 pp.
Lond. : Sweet & Maxwell, *and* Stevens. 1935. 5s. P.

Birmingham Civic Society
Report, 1934-5.
[1935.] R.

DRAWINGS

George (*Sir* Ernest)
[Drawings of various buildings.]
35 sheets. *D.* n.d.
Presented by Mr. Alfred B. Yeates [*Ret. F.*].

Tapper (*Sir* Walter)
Church of the Annunciation, Old Quebec Street, London.
18 sheets. *D.* 1912.
Presented by Mr. Michael Tapper [*F.*].

Correspondence

SLUM DWELLINGS

39 Maddox Street, W.1.
1.1.36.

To the Editor, Journal R.I.B.A.

Sir,—The letters in your current and previous issues from Messrs. Trystan Edwards and E. G. Holtom raise many vital points regarding the housing of the community in general and the poorer classes in particular

Mr. Holtom, commenting upon the unhealthy and dangerous economic aspect of present slum clearance and re-housing schemes, concludes with the following statement : " The condition of all classes of building throughout the country is becoming appalling. Repairs, renewals and painting are neglected ; no one can afford them."

Only last week-end I passed through a working-class housing estate that was erected just after the War by a well-known U.D.C., the houses having been well designed by responsible architects. Repainting and distempering were badly needed, and the concrete fencing posts were disintegrating under the action of the weather, leaving skeleton-like remains with lumps of concrete attached thereto. This state of affairs by no means applies only to working-class dwellings, but is also evident in the larger private houses where the normal owner is so hard put to feed, clothe and educate his family that by the time rates and Schedule A, etc., are paid what remains, if any, is not sufficient to effect the repairs necessary for proper maintenance of his property. The case, however, of the thousands who have been buying houses on the instalment plan and have, in addition to the above-mentioned commitments, to face interest payments to building societies and insurance companies is, as Mr. Holtom implies, not a happy or healthy one to contemplate. On one new estate upon which the writer has occasional business there is provided ample evidence of the dangerous position that is now or may be created in the future by the high cost of modern housing to the individual *pro rata* to his total income. Surely Mr. Holtom is correct in assuming that such hire-purchase methods within the present money system can only end in trouble.

To turn to Mr. Edwards' long and interesting letter, he makes a statement which appears to be fundamental to any real progress in housing development. He says " Rebuilding Britain should imply a free hand to remodel the existing towns and to build new ones where necessary." What do these words imply ? Surely some restriction upon the wild speculation in real estate values which during the past two years have increased land values in many cases out of all proportion to true value.

A most interesting article under the heading " Territorial Planning " appears in the current issue of the *New Statesman and Nation*, by William A. Robson, and this article contains most illuminating figures upon the slow progress made in town planning in spite of legislative powers available. Quoting the 16th Annual Report of the Ministry of Health, he says* (see p. 5) : " Thus all the (planning) schemes which have been either approved or submitted comprise less than 175,000 acres—that is, about 1/215th part of England and Wales." In referring to the lack of decency in the industrial towns that grew up in the nineteenth century, he adds : " We look back on the Victorians who made them with pity, for they knew not what they did. But future generations will look back on us with anger and contempt, for we know very well what we are doing and we know it is barbarous."

Of course, most people know that what we are allowing now in housing and industrial development is wrong, but no serious National attempt is made to stop it. We are " Fouling our own nests " by countenancing profiteering in the greatest security that God gave us—" the land."

Unfortunately, many of our own profession are forced by sheer economic necessity to take part in acquisition and development of properties in towns and villages where the motive power behind the whole development is not the really ultimate good of the community but something less wholesome. As one charming and successful speculator remarked to the writer quite recently, in response to a protest, regarding a proposed " Corner " in all the available land in a delightful old town not so far from London, " Oh ! well, if my syndicate doesn't acquire and develop it somebody else will." These words might be called typical of the attitude of the average speculator—and who can blame him when he is, under present conditions, so often able to do as he likes with something which should be conceived on a National scale, and where individual interest should be subservient to that of the community.

I am, Sir,
Yours faithfully,
J. D. Hossack [*F.*]

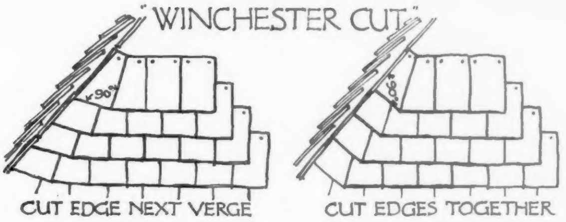
*Mr. Robson also quotes statistics relating to the making of resolutions, 1,161 in number affecting 1,328 areas and covering 13,340,735 acres, but as 938 (covering nearly 9 million acres) were passed under legislation prior to the T. and C. Planning Act 1932, it is clear that these resolutions are mainly of the pious type, since there has been ample time for them to have matured into effective schemes had the local authorities been in earnest.

THE WINCHESTER CUT

12 Park Street,
Minehead, Somerset.
6.1.36.

To the Editor, JOURNAL R.I.B.A.

SIR,—I have read with great interest and general agreement Mr. Minton Taylor's thoughtful review of the book on Slating and Tiling, but I would like to question the point he makes as to the "Winchester Cut." As, no doubt, he is aware, this takes its name from the frequency with which it may be seen in old tile-hung houses in and around Winchester—it is comparatively rare elsewhere, except in revived form in modern work. In the old examples the most usual method was the one depicted in the book, which Mr. Taylor questions. A photograph of a Winchester example in the late Nathaniel Lloyd's "Building Craftsmanship," shows this very clearly, and in my own chapter in Vol. II of Longman's "Building Construction," Edition 1913, it is similarly shown.



I do not question the benefit which might follow the course Mr. Taylor advocates, but personally prefer the older alternative, since by his method the uncut upper edge and right-angled junction with the verge involves a break in line at the end of each course which seems to me too abrupt—the accompanying rough sketches will make this plainer.

Yours faithfully,
EDWIN GUNN [*A.*]

Obituary

MR. E. M. GIBBS [*F.*]

We have received the following memoir of the late E. M. Gibbs, Esq. [F.] from Mr. Charles M. Hadfield [F.] and Mr. James R. Wigfull, both of whom were closely associated with Mr. Gibbs in his work for architectural education in Sheffield.

The outstanding characteristic of Mr. Gibbs was his devoted service to the cause of architectural education, a devotion which he maintained with unflagging zeal throughout his long and active professional life, and which entitles him to an honoured place amongst those whose names are associated with the reforms of the last fifty years. During the whole of this period his activities and enthusiasms were unceasing and noteworthy, alike in the form of personal service and generous financial sacrifice and leadership. The Department of Architecture of Sheffield University as it exists to-day is—in a true sense—his monument. It is almost 44 years ago that he inaugurated local effort by a paper on "Architectural Education" read before the Sheffield Allied Society, and between that date and the opening of the university in 1905 much spade work was done under his auspices in the training of students at the local school of art, by the holding of classes in design, the encouragement of outside sketching and measuring, and other works carried out through the local society. On the opening of the Sheffield University he put forward a scheme of architectural education which he had himself worked out in great detail, the ultimate issue of which was the formation of a Department of Architecture with Mr. W. S. Purchon as its first lecturer, visiting, in company with the latter and Mr. J. R. Wigfull, the principal architectural schools of the period, and enlisting the support of his professional colleagues. That this foundation sunk was well and truly laid is shown by its survival during the stress of 1914-19, and during the following difficult years, when, with shrinking numbers, and only a part-time lecturer available, such survival was for a time seriously threatened. With the passing of this period and its reconstitution under the present lecturer, Mr. Welsh, with the marked success which has followed his appointment, Mr. Gibbs, now advanced in years, showed no falling off in interest, and active participation wherever possible.

He remained a member of the Board of Architectural Studies and took unfailing pleasure in attending exhibitions of students' work, and since the full recognition of the school by the R.I.B.A. he has acted as an honorary examiner in professional practice. There can be few instances of activities in a good cause maintained over so long a period and with an energy so unremitting, and it is a privilege highly valued by the undersigned, who have worked in association with him through much of his long life, to render this tribute.

CHARLES M. HADFIELD [*F.*]
JAMES R. WIGFULL [*F.*]

We have received the following memoir of Mr. Gibbs from Mr. W. S. Purchon [*F.*].

May I add a brief tribute to the memory of Mr. E. M. Gibbs, of Sheffield? As the first lecturer in charge of the school of architecture at the University of that city, I spent much time with him in the early days of that school, for which he worked so hard before its establishment in 1907, and which he has assisted in all possible ways ever since.

I count it a great privilege to have worked with him in that way, for he was a man of great sincerity of purpose, and one who was exceptionally thorough in all that he undertook. The success of that school, under its present head, Mr. Stephen Welsh, M.A. [*F.*], in securing the final recognition of the R.I.B.A., must have been a great source of satisfaction to Mr. Gibbs, and in its future development it will be a lasting memorial to him.

W. S. PURCHON [*F.*]

ARTHUR C. BLOMFIELD [*F.*]

Arthur Conran Blomfield was born on 15 December 1863 and died on 22 November 1935.

He was educated at Haileybury and Trinity College, Cambridge. After taking his degree he left England for about two years to study architecture abroad. On his return he served a short term of articles with the late Sir Ernest George, preparatory to joining his father, the late Sir Arthur Blomfield, A.R.A., then in practice at 6 Montagu Place, W.1. His late brother, Mr. Charles James Blomfield [*F.*], was already in practice with his father, and the firm carried on for some years under the title of Sir A. W. Blomfield & Sons. Sir Arthur died in 1901 and the two sons carried on a very extensive business, in which church work was predominant.

From the death of his father he and his late brother, Charles, carried on under the name of the old firm, until the beginning of the Great War in 1914.

Mr. Arthur Blomfield was responsible for many well-known buildings, including the Law Union & Rock Buildings in Chancery Lane; Bank Buildings in Princes Street, E.C.; Christ's Hospital Buildings, Great Tower Street; Barclays Bank, Pall Mall; besides various other branch banks for Barclays and the Westminster Bank. Of his country houses, Hollingdon House stands out as his best.

He was also architect to King Edward VII at Sandringham.

During the war he left his brother (who had taken up military duties) and took into partnership his head assistant, Mr. A. T. Driver [*F.*]. At this time they carried on business at the Architect's Office, Bank of England, of which Mr. Blomfield was at that time architect.

During the latter part of the war he transferred his office to the Grocers' Hall (he had held the position of surveyor to the Grocers' Company for 35 years) and carried on under the name of Arthur Blomfield and Driver [*FF.*]. The premises known as 8, 9 and 10 Great George Street, S.W.1, were their work. Also those very excellent buildings known as 4 Crosby Square and the Eastern Bank, Crosby Square.

Just recently Mr. Blomfield added four large blocks to the Graylingwell Hospital at Chichester and carried on the good work begun by his father 45 years ago.

As surveyor to the Grocers' Company Mr. Blomfield was responsible for some excellent buildings at Oundle School, Northampton, of which their beautiful Memorial Chapel stands out. His last works there were the new gymnasium, additions to the sanatorium and the completion of the school quadrangle.

Mr. Driver retired in 1932 and Mr. Blomfield carried on alone until May 1935, when he retired from active practice. Unfortunately he lived only six months to enjoy his freedom. He was a first cousin to Sir Reginald Blomfield.

He always took an active part and great interest in all architectural benevolent societies. He was associated with the Architects' Benevolent Society, the Artists' Benevolent Society and the Surveyors' Benevolent Society.

He was a grand old gentleman of a grand old school, and lived up to his reputation and was respected by all. His thoughts were for others even until the last. He left a request that no flowers should be sent to his funeral, but those who wished to do so should instead send a tiny donation to the Architects' Benevolent Society, and so he died as he lived—an architect and a gentleman.

L. H. HARRINGTON [*F.*]

AUSTIN WOODESON, O.B.E., F.S.I. [*F.*]

Mr. Austin Woodeson, late chief architect of the Public Works Department in Ceylon, died on 24 November at a Bournemouth nursing home after a short illness.

Born in 1873 in Reading, Mr. Woodeson received his architectural training in the office of Mr. Roland Howell. In 1898 he first went to Ceylon as chief draughtsman and quantity surveyor in the Public Works Department. With the expansion of the Building Branch of the Department the office of chief draughtsman and quantity surveyor developed into that of the chief architect. The Architectural Branch, which did not exist as such in 1898, gradually came into existence and grew in size until in 1925 there was a large staff of qualified architects, quantity surveyors and drafting staff.

Among the major works carried out during his period of office are the De Soysa Bacteriological Institute, Training College, General Hospital Administration block, Technical College, Minor Courts and Fiscals Office, Colombo, Public Works Department Head Office, Central Telegraph Office, Government Printing Office, Outpatients' Department General Hospital, Colombo, the new Royal College, new Anatomical block, Medical College, new Treasury Building, Chalmers' Granaries, the University College buildings, Police Training Schools, Lunatic Asylum, Angoda, Government Dental Institute, new three-storey block General Hospital, Colombo, new Customs House, Colombo, new Physiological block Medical College, new Supreme Court and District Court buildings, Galle, new Council Chamber and Secretariat buildings.

The largest undertaking with which Mr. Woodeson was concerned is the imposing blocks of the Council Chamber and Secretariat on Galle Face.

In 1925 Mr. Woodeson spent a month in India studying architectural styles in connection with the Ceylon University project. In 1928 he devoted a brief period of his leave to work in London on Sir Herbert Baker's plans for the new Queen's House, and in the following year he was sent again to India for two months in connection with the Government's housing and town planning schemes.

Evening classes in building construction, drawing and quantities at the technical schools were established largely by Mr. Woodeson and they have been carried on successfully for many years. Himself an extremely popular lecturer, he contributed materially to the furtherance of the knowledge of building construction and draughtsmanship. In recognition of his services the Austin Woodeson medal was founded: this is presented annually to the best student of the year in those subjects.

Mr. Woodeson was for over 20 years the hon. secretary of the Engineering Association of Ceylon. He was a keen Freemason, and in 1928 was elected Deputy Grand Master in Ceylon and in 1930 District Grand Master.

Mr. Woodeson was elected a Fellow of the Institute in 1914. He was also a Fellow of the Surveyors' Institution. In 1931 the O.B.E. was conferred on him for architectural services in Ceylon.

EDWARD UNWIN, A.R.I.B.A., M.T.P.I.

The Editor has very kindly allowed me to write a note about my only son, Edward, who died on Friday, 10 January, and to tell his and my colleagues a few things about him which I should like them to know.

He died of a disease for which no remedy is yet known, and he bore the five months of illness in bed with unfailing serene good temper and courage, which has filled all who were about him with admiration and respect.

Good temper, and fairness towards those with whom he had dealings, were characteristic of him always. He had an imagination so lively that he often lived in an imaginary world, as when in childhood for months together he hardly emerged from being Mowgli of the Jungle Book.

Lessons and letters were hard for him; but he had a good brain, and early began to penetrate into the reasons for things. This, with his imagination, gave him an unusual equipment for planning on a large scale, which proved of great value in his work with me for the Greater London Regional Planning Committee. He was educated chiefly at King Alfred School, Hampstead, and at St. George's, Harpenden; was preparing to take the course in economics and architecture at Cambridge, in his twentieth year, when the war broke out. He immediately joined an Ambulance Corps, and from August 1914 to 1916 he worked in Belgium and France with the Red Cross; an experience of suffering and death which left an indelible impression on his character, and led to his writing some verses, one of which indicates the faith and philosophy in which he lived and died.

Death's not the end of a drama,
But only the change of a scene,
A break in the play that's for ever,
For the actors to rest in between.

He felt, however, that in the Red Cross he was not taking his full share of war risks, and joined the R.N.V.R., to which he was drawn by a passionate love of the sea and an unusual capacity for seamanship. Without any training he served as second officer on a trawler mine sweeping in the North Sea, to the great satisfaction of his Chief, until the irregularity was discovered. He was then given a short course of training and thereafter served in the Motor Boat Patrol, ultimately as Lieutenant commanding M.L.154, in which he had the good fortune to rescue 15 persons from the *Leinster* when she was torpedoed in the Irish Sea.

The loss of five years changed his plans; the love of the sea nearly led him to take to that as a profession: but during the war he had married Jennie, the daughter of John Wardle, of Grimsby, who had become and has remained his "first mate" in all his work and recreations; also he thought of us and of our hopes that he would use his talents to follow along similar lines of activity. He studied architecture at University College and took a short course at the A.A. Never at his best in examinations, he passed the needful to become A.R.I.B.A., and later M.T.P.I. He worked for his uncle, Barry Parker, at Letchworth; spent a year in various offices in America; and when I retired from the Ministry of Health and became adviser to the Greater London Regional Planning Committee he co-operated with me and made a contribution to that work, and to the two reports issued, of much greater importance than is generally known: indeed, I came to rely very much on his judgment and on his thoughtful suggestions.

We have lost in him one with unusual capacity for large-scale planning, a type much needed and too little developed by our present methods of training and business. His architectural work, besides a few private houses, included a housing scheme at Maldon, Essex, the Old Folks Cottages, built in memory of the Tolpuddle Martyrs by the Trades Union Council, and one of the early Open Air Infant Schools.

He was for some time a member of the Practice Committee of the Institute, and was Joint Secretary with T. S. Barnes of the Housing and Slum Clearance Committee, whose report was issued last year. Apart from his work, his chief interests were in social and political subjects, and in anything connected with boats and water. He helped to found and was chairman of the British Canoe Association, which rapidly reached a membership of nearly 400, and he spent many holidays exploring the rivers of England and several European countries. He also promoted and was chairman of the Production for Use League, which sought to encourage the provision of opportunities for work useful to themselves for the unemployed. He was too independent in thought to be a good party politician, but always supported the Labour cause, and was chairman of the local Labour Party.

He was very inventive, and had great sympathy for new methods; but he was essentially a lover of the country, of simple and informal habits, and much of the complication of modern life in large cities bored and distressed him; he and his wife were most happy to escape to a sailing boat on the coast, or with tent and portable canoe, at the week-end, to gather about them a group of others to whom the rivers and the open country meant more than anything to be found in the town. Glad enough he was when his father could join him on the sailing trips. That father must not, however, expect his colleagues to be interested in more of his cherished memories!

RAYMOND UNWIN.

DAVID REGINALD GRAY [*L.*]

Mr. D. R. Gray died on 11 September 1935 at the age of 44. He was born in 1891, educated at Dudley Grammar School and King Edward's School, Birmingham, and articled to Mr. Walter Wright, of Dudley. In 1915 he joined the 5th Worcestershire Regiment and was wounded at Vimy Ridge. On demobilisation in 1918 he started in private practice as an architect in Dudley in partnership with Mr. George Frederick Webb, the firm practising under the name of Webb & Gray. Mr. G. F. Webb will carry on the practice under the same name and at the same address.

The architectural work of the firm included the County of Rutland Memorial Hospital at Oakham; King Edward VI School Hall at Stourbridge; theatres at Stourbridge, Kidderminster and Cradley Heath; as well as various churches and chapels, factories, housing and domestic work.

Mr. Gray was elected a Licentiate of the Institute in 1925.

NOTES

R.I.B.A. NEW BUILDING FUND

LIST OF CONTRIBUTIONS RECEIVED OR PROMISED

	£	s.	d.
Brought forward	13,071	2	8
R. J. Dennehy [Fellow of the Royal Institute of the Architects of Western Australia, Inc.]	1	1	0
In addition, the following Allied Societies have made further contributions under the arrangement whereby for a limited number of years a percentage of the annual contributions paid by the R.I.B.A. to the Societies in respect of the R.I.B.A. members thereof will be credited to the Fund*:			
Aberdeen Society of Architects	5	16	11
Berks, Bucks and Oxon Architectural Association	16	18	10
Birmingham and Five Counties Architectural Association	21	15	5
Devon and Cornwall Architectural Society..	0	2	1
Dundee Institute of Architects	3	10	0
Glasgow Institute of Architects	17	1	7
Inverness Architectural Association	1	13	7
Leicester and Leicestershire Society of Architects	9	18	10
Liverpool Architectural Society	14	2	1
Manchester Society of Architects	0	7	8
Norfolk and Norwich Association of Architects	6	3	2
North Staffordshire Architectural Association	2	11	1
Northern Architectural Association	25	11	8
Nottingham, Derby and Lincoln Architectural Society	15	11	6
Royal Institute of the Architects of Western Australia, Inc.	12	12	0
Royal Society of Ulster Architects ..	3	17	8
South Eastern Society of Architects ..	85	10	1
Suffolk Association of Architects	3	12	10
Wessex Society of Architects..	18	6	9
West Yorkshire Society of Architects ..	27	3	11
York and East Yorkshire Architectural Society	9	15	4
*The Building Fund is credited with an agreed percentage in respect of the subscriptions paid by London members.			
Up to the date the sum of	613	16	7
has been credited, and a further amount of..	22	1	0
is due up to the end of 1934, and will be included in the amount due to be credited for the year ended 31 December 1935.			
TOTAL RECEIVED AND PROMISED TO 13 JANUARY 1936	£14,010	4	3

BRITISH INSTITUTE IN PARIS

SCHOLARSHIPS

The Trustees and Committee of the British Institute in Paris have decided to offer scholarships to be held in Paris during 1936-37. The conditions on which the scholarships for the next academic year will be awarded are given below, but the following additional information may be useful to persons who are considering whether to apply for the financial assistance offered.

The Committee are desirous of aiding not only students who wish to pursue some course of advanced study in Paris, but also students who are anxious to obtain a thorough knowledge of contemporary French life for business or other reasons. They are accordingly prepared to consider applications from men and women who are engaged, or propose to engage, in commerce and industry, as well as from those concerned primarily with teaching or research.

The scholarships will not ordinarily be available for students spending a period in France as part of the ordinary degree course.

CONDITIONS.

1. Scholarships to a total value of £600 are offered by the Committee of the British Institute in Paris, tenable during the year 1936-7.

2. They will be given to men and women of British nationality, who are prepared to follow courses at the Guild of the British Institute in Paris, and, if desirable, in any of the Schools of Learning in Paris. Preference will ordinarily be given to candidates who are not less than 21 years of age on 31 July 1936.

3. It will be a condition of the award of scholarships that candidates must possess a knowledge of French sufficient to enable them to pursue their proposed course with success.

4. Holders of the scholarships will be expected to become members of the Club of the Institute at 6 rue de la Sorbonne, and to take part in its social activities.

5. If satisfactory arrangements can be made for accommodation at the Franco-British House at the Cité Universitaire, Scholarship holders will be expected to reside there.

6. Applications from candidates desirous of pursuing courses of study for a post-graduate degree or other similar purpose will as a rule only be considered if the candidate has already obtained a 1st or 2nd Class in his Final Honour School.

7. The selection will be made by the Education Committee in London.

8. The scholarships will range in value from £25 to £150 each, according to the character of the course and the needs of the student.

9. The scholarships will normally be tenable for one academic year, i.e., roughly from October to July, but may be for shorter periods.

10. The payments will be dependent upon reports from the Director in Paris, and other persons under whom the student may be working in British or French institutions, that the conduct and the work of the holder of the Scholarship have been satisfactory.

11. Candidates must state the course of study which they propose to follow in Paris.

12. Applications should be sent in through the Vice-Chancellor of the University, or the head of any other Educational Institution now being attended, to The Secretary, British Institute in Paris, 1 Old Burlington Street, London, W.1, before Saturday, 29 February 1936. Forms of application, which must be used by candidates, may be obtained on application to the Secretary, Mr. B. S. Townroe.

THE TITE PRIZE AND THE VICTORY SCHOLARSHIP, 1936

PRELIMINARY COMPETITIONS

The attention of intending competitors is called to the fact that the Preliminary Competitions for the Tite Prize and the Victory Scholarship will be held in London and at centres in the provinces on Thursday, 5 March, and Friday, 6 March 1936 respectively.

Forms of application for admission to the Preliminary Competitions may be obtained at the R.I.B.A., 66 Portland Place, London, W.1. *The closing date for the submission of forms of application is Wednesday, 5 February 1936.*

Final Examination Result

THE FINAL EXAMINATION, December 1935.

The Final Examination qualifying for candidature as Associate R.I.B.A. was held in London and Edinburgh from the 4th to 12th December 1935.

Of the 198 candidates examined 89 passed (26 in Part 1 only) and 109 were relegated.

The successful candidates are as follows :

Akeroyd, Alfred.
Allen, Edgar.
Barber, Anthony Gerald (*Part 1 only*).
Barnes, William Edwin (*Part 1 only*).
Barrett William (*Part 1 only*).
Barrow, Thomas James Douglas (*Part 1 only*).
Beard, Philip Bernard (*Part 1 only*).
Beecroft, Charles Roy.
Bloore, David Burch.
Bowen, Harman Aaron.
Bradley, George Birchenall.
Brooks, Arthur.
Brown, Austen Kirkup.
Brown, Stanley Trevor.
Byrom, Charles Neville.
Chasser, George McDonald.
Colclough, Thomas James Hancock.
Cooper, Arthur Ernest.
Cooper, Laurence William Alexander.
Craddock, Frederick David (*Part 1 only*).
Cremer, Lewis Bernard Henry.
Doody, Cyril Herbert (*Part 1 only*).
Dumble, Alan.
Dungey, William John Hugh.
Dyer, Leonard Stacey.
Farrow, Ernest (*Part 1 only*).
Forbes, John.
Fowler, Norman Harold.
Fox, Ewart Lyndall.
Gerrard, Philip.
Griffiths, Leslie Melville.
Hancock, Geoffrey Arthur (*Part 1 only*).
Harris, Arthur Noel (*Part 1 only*).
Hawkes, Harold William Gifford (*Part 1 only*).
Head, Paul Ernest.
Hewitt, Alfred William Robert.
Hoare, Eric Lester Treadaway.
Hodgson, Alan Hew.
Houfe, Eric Alfred Scholefield.
Hough, Eric.
Jackson, Harry.
Jones, David Archibald.
Kaye, Duncan.
Lazenby, Arthur (*Part 1 only*).
Lowry, Wilfred Laurence.
Lyons, Edward Douglas.
Manning, Oliver David George (*Part 1 only*).
Mason, Edmund Charles (*Part 1 only*).
Mennell, Gerard Bevington (*Part 1 only*).
Mills, Reginald Philip (*Part 1 only*).
Moore, Thomas Eric (*Part 1 only*).
Morris, Noel Ennever Seton (*Part 1 only*).
Moseley, Horace George (*Part 1 only*).
Nealon, Kenneth (*Part 1 only*).
Pembery, Gerald Griffin (*Part 1 only*).
Penny, Charles Royle.
Pitt, Hal Lungley.
Priestman, Harold Dent.
Ray, Gilbert (*Part 1 only*).
Reece, Noel Lees.
Reid, James George.
Robinson, George Duncan.
Rosenberg, Gerhard (*Not a British Subject*).
Russell, Arthur Frederick.
Sadler, Ernest Howard.
Short, Harold.
Siggers, Raymond Rush.
Smalley, Ernest Alfred.
Smith (Miss) Carmen Stella Gregory (*Part 1 only*).
Spare, Kenneth Arthur (*Part 1 only*).
Stower, Frank.
Sutton, Allan.
Taberner, Edgar.
Taylor, Ernest.
Thomas, Arthur Albert.
Thompson, Alan (*Part 1 only*).
Townsend, Douglas Charles.
Tweddell, Noel.
Volonterio, Louis Rigola (*Part 1 only*).
Weegmann, Henry Christian.
Weir, Ernest John.
West, Frank George.
Weston, Norman Ernest Godfrey.
Wheatley, Norman.
Wilson, Patrick.
Wilson, Ronald John.
Wood, Lesley.
Young, Leonard James.
Young, Ronald McPherson Watson.

THE SPECIAL FINAL EXAMINATION.

The Special Final Examination qualifying for candidature as Associate R.I.B.A. was held in London from the 4th to 10th December 1935, and in Edinburgh from the 4th to 12th December 1935.

Of the 36 candidates examined, 7 passed (3 in Part 1 only) and 29 were relegated.

The successful candidates are as follows :

Bidwell, George Bernard Hopson (*Part 1 only*).
Howard, Frank Foster.
Metayers, Henry Alfred.
North, Thomas Eugene.
Passmore, Richard Leslie (*Part 1 only*).
Whatmore, Charles Sydney.
Williams, Charles Philip (*Part 1 only*).

THE EXAMINATION IN PROFESSIONAL PRACTICE FOR STUDENTS OF SCHOOLS OF ARCHITECTURE RECOGNISED FOR EXEMPTION FROM THE R.I.B.A. FINAL EXAMINATION.

The Examination was held in London and Edinburgh on the 10th and 12th December 1935. Of the 16 candidates examined, 11 passed and 5 were relegated.

The successful candidates are as follows :

Baillie, John Somerville.
Egan, Michael Henry.
Gibberd, Harry.
Gratton, Thomas Oswald White.
Knott, Edmund Vernon.
McKay, Joseph.
Morrison (Miss) Rona Helen Inch.
Noble, John Baillie.
Paton, Adam.
Stewart, Cecil Graham.
Woodrow (Miss) Annie Crawford.

ALLIED SOCIETIES

THE ROYAL INSTITUTE OF THE ARCHITECTS OF IRELAND

Annual General Meeting

On the 19 December 1935 at 8 Merrion Square, Dublin, the annual general meeting of the above body was held, the president, Mr. H. Allberry [*A*.], occupying the chair.

The minutes of the previous general meeting having been signed, the report of the scrutineers of the ballot for Council for the year 1936 was read and the president announced the following as duly elected :—Professor R. M. Butler and Messrs. J. V. Downes, L. F. Giron, C. Harrington, F. Hayes, H. V. Millar, J. J. Robinson and T. F. Strahan. Mr. Vincent Kelly, representing the Architectural Association of Ireland, will also be a member of the new Council.

The annual report of the Institute's activities during the past year was subsequently read by the honorary secretary, Mr. R. C. Keefe, and its adoption was moved by Mr. T. J. Byrne and seconded by Mr. Cyril Harrington. Mr. Vincent Kelly suggested that the definition in the report of what constituted a qualified architect might be misinterpreted in view of the statutory rules, in connection with housing, issued by the Department of Local Government. He also thought the possibility of holding the exhibition of architectural photographs, that was attracting so much attention in Great Britain, should be further explored. Mr. Manning Robertson commented on the number of candidates that were relegated in the Institute's series of professional examinations. The president having replied to the points raised, the report was passed unanimously. Mr. Edwin Bradbury, hon. treasurer, read the statement of accounts and hon. treasurer's report which, on the motion of Mr. Vincent Kelly, seconded by Mr. S. Ashlin, were unanimously adopted. Messrs. Thomas Geoghegan & Co. were re-elected auditors.

In the course of a general discussion that followed, reference was made to a scheme, at present under consideration by the Council, to erect a lecture hall at the rear of the Institute's premises, a proposal that was favourably received by the meeting. It was also resolved that the Institute should approach the Corporation, urging that immediate steps be taken to preserve Weavers Hall from a pending demolition or reconstruction. Mr. Sedgwick Keatinge, speaking of the recent competition for the new Government Buildings in Kildare Street, thought the response—considering the number of members on the Institute's roll—was disappointing. He understood that only thirty-five sets of drawings had been submitted. He felt that the Council should see that adequate time was allowed for the preparation of the plans required by the adjudicators and also that the number and character of such drawings should be kept within reasonable limits. He was in favour of a preliminary competition based on general principles and sketch designs, and the selection from competitors of an approved few to enter for the final competition. The President said that Mr. Keatinge's practical suggestion would receive the attention of the Council when it met in the new year.

SHEFFIELD AND S. YORKS AND DISTRICT SOCIETY OF ARCHITECTS

Lecture by Mr. L. H. Keay, O.B.E., M.Arch. [*F*.]

On 5 December Mr. L. H. Keay [*F*.] read a paper before the Sheffield and South Yorks Society on Housing and Re-housing. In opening his speech Mr. Keay said that he regretted the comparisons recently made between the work of private and official architects. He suggested that the housing problem could only be solved satisfactorily by the direct action of the local authorities assisted by co-operative action of public utility societies where possible.

Mr. Keay gave a brief survey of the progress of housing legislation since the war. He referred to the effects of the M. of H. Circular No. 1331, urging a more energetic attack on slums, and to the local authorities' schemes and to the subsequent controversy in which some housing authorities had declared against any rebuilding on cleared sites and in favour only of the development of new estates. Mr. Keay said that the housing experts in big cities realised that to be effective central re-development must not be piecemeal. The Act of 1933 was encouraging to them, for it enabled local authorities to acquire any properties necessary to complete a scheme, whether they had been condemned or not. Mr. Keay put up a spirited case for flats in Liverpool, which was the first city in the country to build municipal flats. He disagreed fundamentally with the opinion that " independence and self-respect could not be created in ' community houses.' "

He then showed slides and described Liverpool housing schemes in detail, and concluded by hoping that his audience would be satisfied that Liverpool had considered " not only the essentials of good planning and design, but also a full co-operation with all departmental and other interests . . . in a way which will effect a considerable saving on its health and other services, and lead to greater happiness and contentment."

NORTHERN ARCHITECTURAL ASSOCIATION

Presidential Address

Mr. Harold Oswald, J.P. [*F*.], opened his Presidential address to the Northern A.A. on 9 October last by referring to the fact that his grandfather, one of the founders of the Association in 1858, had been president in 1858 and his father in 1894. Having referred with regret to the deaths of Mr. William Milburn, Senr., and Mr. C. S. Errington, both past-presidents, he surveyed the successful work during the year of the various organisations within the Association, the Teeside and Cumberland branches, the school at Armstrong College and the Students' Club. The Association could congratulate itself on its total membership of 445 (in 1891 it was only 66). They were now reaping the benefits of their forefathers' work, but every member to-day must continue to urge interest and support of their Association.

Mr. Oswald then referred briefly to registration and to the greater interest now being shown in architecture by laymen. The past year had witnessed great activity in the building trade, but the architects, he suggested, had not been as busy as one could have wished. Apart from the new County Council Offices there had been few important buildings in progress. Apparently, said Mr. Oswald, in future the public purse should be regarded as the great patron. It should be one of their chief duties to impress upon public authorities that the best and surest results were only to be obtained by the employment of those who are technically fit for the work they undertake. Mr. Oswald urged greater readiness on the part of architects to avail themselves of the extreme freedom of expression in the new and current type of design.

Mr. Oswald next referred to the scathing comment on modern architecture made at the Glasgow Conference. He suggested that the diseased side of modernism would die and that we would find satisfactory methods of expressing in our designs something that had been lacking hitherto. Architecture had never really stood still, and it never would do so.

He next mentioned the air survey which had been begun and expressed the hopes that whatever maps resulted would not lower

the high standard set by the existing ordnance survey. He referred also to the debates concerning Newcastle Town Hall and questioned the advisability of going outside the business centre of the city for a site. It is certain, he said, that a short-sighted policy on the stilted lines of their City Hall and Baths building would be disastrous and resented by all. A long reference was made to the new Ribbon Development Act which, he said, gave great opportunities for securing wise building development, and gave architects a chance of proving the advantages of well thought-out planning. It was to be hoped that the authorities concerned would work together and use the Act not as a restrictive measure but really broadly as a stimulus to town and county planning.

Mr. Oswald spoke critically of the present craze for flats, and referred also to the possibilities of bungalows if well designed. In conclusion he mentioned the difficulties of urban traffic and suggested the building of more central garages which the public should use instead of leaving their cars in the streets.

NORFOLK AND NORWICH ASSOCIATION OF ARCHITECTS

At the annual meeting of the Norfolk and Norwich A.A. on 8 January the Report of Council for 1935 was presented, the officers and Council who are to take office on 1 July next were elected and the President delivered his annual address.

The Report showed that the total membership was 102, of which 55 were full members. Three Ordinary General Meetings, one Students' Meeting and 11 Council meetings had been held during the year; there was one special meeting for members only at Hill Cottage, Harvey Lane, by invitation of the President and Mrs. E. W. B. Scott, and one informal meeting when the heads of schools in Norwich were entertained to tea so that the R.I.B.A. views on architectural education in schools could be explained. It was decided that one experimental lecture should be given in each secondary school. A supper and meeting had been held jointly with the Master Builders' Association, and there had been also the great annual outing, a cruise to Holland, when members and friends from other Allied Societies made up a party of 109. One social evening had also been held. The report also recorded that the President had been a member of the local Council for the British Association meeting at Norwich during the summer.

For the next Association year Mr. F. H. Swindells [*F.*] was elected President, Mr. J. O. Bond [*F.*] and Mr. H. C. W. Blyth [*L.*] Vice-Presidents, Mr. E. W. B. Scott [*F.*] Hon. Librarian, Mr. T. G. Scott [*F.*] Hon. Editor, and Mr. E. H. Skipper [*F.*] Hon. Secretary.

In his Presidential speech Mr. E. W. B. Scott referred to changes which it had been decided to make in the dates of the annual meeting and the annual election, which were in future to be in October and June respectively. In saying that the year had been a good one on the whole, he referred especially to the new scheme for properly organised lectures to schools. Publicity work was of ever-increasing importance and he welcomed the work of the R.I.B.A. Public Relations Committee. In their district they were grateful for the generous treatment they had received from the local Press.

Mr. Scott stated that he had hoped that it would have proved possible to institute medals for architecture in the Association's area, but this had proved impossible.

Next the President referred to Registration, and particularly to certain misapprehensions, which, he suggested, existed. An amending Act was urgently wanted and action was being taken to prepare one, but in the meantime they could be thankful for what they had. He called upon members to be regular in their payment of the annual registration fee.

Finally, he spoke on education and on progress made in their district, but referred with disappointment to the quality of the measured drawing work done by their students and referred to the opportunities that occurred for drawings of real value to be made when interesting buildings were demolished.

Appended to the Annual Report were reports relating to the work of various societies, the Norwich Society, the School of Art Architectural Classes, the Worshipful Company of Plumbers and the Caistor Excavation Committee.

Membership Lists

APPLICATION FOR MEMBERSHIP
ELECTION: 10 FEBRUARY 1936

In accordance with the terms of Bye-laws 10 and 11, an election of candidates for membership will take place at the Council Meeting to be held on Monday, 10 February 1936. The names and addresses of the candidates, with the names of their proposers, found by the Council to be eligible and qualified in accordance with the Charter and Bye-laws are herewith published for the information of members. Notice of any objection or any other communication respecting them must be sent to the Secretary R.I.B.A. not later than Tuesday, 28 January 1936.

AS FELLOWS (7)

BARTLETT: PERCY JAMES [*A.* 1922], Chief Architect, Messrs. Boots, Ltd., Chemists, Nottingham; 19 Herbert Road, Sherwood Rise, Nottingham. Proposed by E. Bower Norris, Major T. Cecil Howitt and Alfd. H. Barnes.

COLE: ERIC [*A.* 1922], Dyer Street House, Cirencester; Perrotts Brook, Bagendon, Cirencester. Proposed by H. Stratton Davis, L. W. Barnard and Harold F. Trew.

HAMILTON: IAN BOGLE MONTEITH, B.A.Oxon [*A.* 1920], 16 Old Buildings, Lincoln's Inn, W.C.2; Winns, Lingfield, Surrey. Proposed by Alan G. Brace, Henry J. Chetwood and Charles Cowles-Voysey.

LEWIS: WILLIAM JOHN [*A.* 1921], Cranbrook House, Cranbrook Road, Ilford; 79 Wellesley Road, Ilford. Proposed by Sir W. Alfred Gelder, S. Phillips Dales and Edward Meredith.

YATES: CHARLES WILLIAM, F.S.I. [*A.* 1922], 12 Queen Street, Gloucester; Brunton, Brockworth, Gloucester. Proposed by Harold F. Trew, Colonel N. H. Waller and H. Stratton Davis.

And the following Licentiate who has passed the qualifying Examination:—

LONGSTAFF: THOMAS HENRY, County Architect and Surveyor, Huntingdon; "Monthermer," Huntingdon. Proposed by William A. Lea, Alan W. Ruddle and F. W. Troup.

And the following Licentiate who is qualified under the provisions of Section IV, Clause 4 (c) (ii) of the Supplemental Charter of 1925:—

TAGGART: WILLIAM DAVID REDMOND, 47 Scottish Provident Buildings, Belfast; "Inniscarra," 18 Adelaide Park, Belfast. Proposed by Thomas Houston, R. H. Gibson and R. S. Wilshere.

AS ASSOCIATES (23)

BAIRD: MISS MARGARET MACDONALD [Passed five years' joint course at the Liverpool School of Architecture, the University of Liverpool and the Welsh School of Architecture, the Technical College, Cardiff. Exempted from Final Examination]. 16 Pembridge Crescent, W.11. Proposed by A. Douglas Robinson, Darcy Braddell and Fred G. Hicks.

BROWNRIGG: JOHN EDWARD ANNESLEY, B.A.(Arch.)Lond. [Passed five years' course at the Bartlett School of Architecture. University of London. Exempted from Final Examination]. Stanemore, Pirbright, Surrey. Proposed by L. R. Hiscock, H. S. Goodhart-Rendel and Matthew J. Dawson.

CASSIDY: GEORGE EDWARD [Passed five years' course at the Bartlett School of Architecture, University of London. Exempted from Final Examination], Bristolia, Southampton Street, Farnborough, Hants. Proposed by Professor A. E. Richardson, Professor Patrick Abercrombie and Matthew J. Dawson.

CRANE: MISS YVONNE [Passed five years' joint course at the Department of Architecture, Northern Polytechnic, London. and the Architectural Association. Exempted from Final Examination], Vellator, 43 Coolhurst Road, Crouch End, N.8. Proposed by Howard Robertson, John Grey and Julian Leathart.

GALLOWAY : ERIC MELVIN [Passed five years' course at the School of Architecture, Robert Gordon's Colleges, Aberdeen. Exempted from Final Examination], 226 High Street, Slough. Proposed by James B. Nicol, R. Leslie Rollo and W. David Hartley.

GRACE : JOHN GREENFIELD [Final], 1 Sussex Gardens, W.2. Proposed by Professor A. E. Richardson, Harold Tomlinson and Graham R. Dawbarn.

HUGHES : ALASTAIR SYDNEY WHITLOCK [Passed five years' joint course at the Architectural Association, London, and the School of Architecture, Sydney Technical College. Exempted from Final Examination], 20 Bedford Gardens, W.8. Proposed by Professor Leslie Wilkinson, E. W. Armstrong and E. Guy Dawber.

LEWIS : DAVID HAROLD [Passed five years' course at the Welsh School of Architecture, The Technical College, Cardiff. Exempted from Final Examination], 27 Gildredge Road, Eastbourne, Sussex. Proposed by W. S. Purchon, Percy Thomas and T. Alwyn Lloyd.

MACARTNEY : ROBIN HALLIDAY [Passed five years' course at the Architectural Association. Exempted from Final Examination], 13 Upper Hornsey Rise, N.19. Proposed by E. W. Armstrong, John Grey and Howard Robertson.

MEDLYCOTT : THOMAS ANTHONY HUTCHINGS [Passed five years' course at the Bartlett School of Architecture, University of London. Exempted from Final Examination], 64 Babbacombe Road, Bromley, Kent. Proposed by Professor A. E. Richardson, L. Stuart Stanley and Matthew J. Dawson.

MITCHELL : DOUGLAS WILLIAM, B.A.Cantab [Passed five years' course at the Architectural Association. Exempted from Final Examination], 424 Fulham Road, S.W.6. Proposed by Howard Robertson, the Hon. Humphrey Pakington and John Grey.

OUZMAN : ROSCOE HERBERT [Passed five years' joint course at the Department of Architecture, Northern Polytechnic (London) and the Architectural Association. Exempted from Final Examination], 18 Grove Park Gardens, Chiswick, W.4. Proposed by Ashley F. Benjamin, Howard Robertson and John Grey.

OWEN : EVAN HUGH, Dip.Arch.Cardiff [Passed five years' course at the Welsh School of Architecture, The Technical College, Cardiff. Exempted from Final Examination], Architectural Section, Public Works Department, Pretoria, South Africa. Proposed by W. S. Purchon, J. S. Cleland and V. S. Rees-Poole.

PHILLIPS : MISS MARGARET MARY [Passed five years' course at the Architectural Association. Exempted from Final Examination], 1 Newton Grove, W.4. Proposed by Howard Robertson, Kenneth Dalgliesh and the Hon. Humphrey Pakington.

PURVIS : RICHARD, B.A.(Arch.) [Passed five years' course at the Bartlett School of Architecture, University of London. Exempted from Final Examination], 2 Southlands Grove, Bickley, Kent. Proposed by Professor A. E. Richardson, Matthew J. Dawson and L. Stuart Stanley.

READ : MISS BERYL JOY [Passed five years' course at the Architectural Association. Exempted from Final Examination], 43 St. George's Square, S.W.1. Proposed by Howard Robertson, John Grey and R. E. Enthoven.

RICE : ALWYN EDWARD, B.Arch.Liverpool [Passed five years' course at the Liverpool School of Architecture, University of Liverpool. Exempted from Final Examination], 27 Cavendish Drive, Rock Ferry, Cheshire. Proposed by Professor C. H. Reilly, Professor Lionel B. Budden and F. Anstead Browne.

SHERWELL : MISS EILEEN MARY [Passed five years' course at the School of Architecture, Edinburgh College of Art. Exempted from Final Examination], 13 Midmar Gardens, Edinburgh. Proposed by John Begg, J. Inch Morrison and T. F. Maclennan.

STEEL : DONALD [Passed five years' course at Leeds School of Architecture. Exempted from Final Examination], 93 Honeybrook Road, S.W.12. Proposed by Joseph Addison, T. A. Lodge and Max R. Hofler.

THOMPSON : PATRICK McGOWAN [Passed five years' course at the School of Architecture, Edinburgh College of Art. Exempted from Final Examination], Eastview Lodge, 77 King Harald Street, Lerwick, Shetland. Proposed by John Begg, John Wilson and E. J. MacRae.

WALKER : MRS. WILLIAMINA KATHERINE [Passed five years' course at the Architectural Association. Exempted from Final Examination], 6 Gregory Place, W.8. Proposed by Howard Robertson, the Hon. Humphrey Pakington and John Grey.

WARNE : ERNEST WILLIAM [Special Final Examination], 18 Bernard Street, Claremont, Western Australia. Proposed by A. R. L. Wright, W. J. Waldie Forbes and Eustace G. Cohen.

WILKINS : LEONARD TOM [Passed five years' course at the Bartlett School of Architecture, University of London. Exempted from Final Examination], 44 Eagle Road, Wembley, Middlesex. Proposed by Professor A. E. Richardson, A. Vernon Kislingbury and G. Alan Fortescue.

AS LICENTIATES (7)

EASTICK : CYRIL WALTER, 15 Portman Street, Portman Square, W.1 ; 18 Devereux Road, Southend-on-Sea. Proposed by Melville S. Ward, M. Wheeler and E. B. Hoare.

GIBSON : GEORGE EMBLETON, 144A New Bridge Street, Newcastle-on-Tyne ; 21 Cavendish Place, Newcastle-on-Tyne. Proposed by C. A. Clayton Greene, John W. English and applying for nomination by the Council under the provisions of Bye-law 3 (d).

HEPPENSTALL : NOEL, 3 Station Road, Milnsbridge, Huddersfield ; "Nether Heath," 168 Woodside Road, Lockwood, Huddersfield. Proposed by Norman Culley, Victor Bain and T. Butler Wilson.

KELLY : PERCY ASHBURNHAM, 10 Henrietta Street, W.1 ; 22 Hilltop Road, N.W.6. Proposed by Frank M. Elgood, Edward Hastie and W. David Hartley.

LUNN : JOHN ERNEST, 3 Station Road, Milnsbridge, Huddersfield ; 20 Occupation Road, Lindley, Huddersfield. Proposed by by Norman Culley, Victor Bain and T. Butler Wilson.

ROWE : ERIC KINGDON, Craigs Court House, Craigs Court, 25 Whitehall, S.W.1 ; 3 Windsor Court, Moscow Road, W.2. Proposed by W. E. Watson, Sydney Tatchell and Thos. S. Tait.

WRIGHT : NORMAN, Messrs. P. Walker & Son, W. & B., Ltd., Building Department, 51 Beaufort Street, Liverpool, 8 ; 109 Thomas Lane, Broad Green, Liverpool 14. Applying for nomination by the Council under the provisions of Bye-law 3 (d).

ELECTION OF MEMBERS : 13 JANUARY 1936

In accordance with the terms of Bye-laws 10 and 11, the following candidates for membership were elected at the Council Meeting held on Monday, 13 January 1936.

AS HON. ASSOCIATE (1)

MAXWELL : SIR JOHN STIRLING, Bt., K.T., Glasgow.

AS FELLOWS (13)

BRIARS : REGINALD, M.C. [*A.* 1922], Luton.
CLARK : DUNCAN WALTER, F.S.I. [*A.* 1907], Colchester.
JELLICOE : GEOFFREY ALAN [*A.* 1927].
MORGAN : GUY [*A.* 1926].
PONDER : CLAUD VINCENT [*A.* 1913].
RICHARDSON : FRANK [*A.* 1921], Rotherham.
RUDMAN : WALTER, M.C. [*A.* 1921], Chippenham.
RUWALD : CYRIL CHRISTIAN [*A.* 1920], Sydney, New South Wales.

And the following Licentiates who have passed the qualifying Examination :—

LEACH : ERNEST CHARLES, Liverpool.
STEVENSON : JOHN HAMILTON, Belfast.
STEVENSON : WILLIAM JAMES HAMILTON, Belfast.

And the following Licentiates who are qualified under the provisions of Section IV, Clause 4 (c) (ii) of the Supplemental Charter of 1925 :—

ELLIS : HENRY ALEXANDER RADCLYFFE, Taunton.
QUILTER : WALTER VERNET, Guernsey.

AS ASSOCIATES (20)

Barton: John Carmichael [Passed a qualifying Examination approved by the Board of Architectural Education of the Royal Australian Institute of Architects].

Boxall: Gordon Charles [Passed five years' course at the Architectural Association. Exempted from Final Examination], Chatham.

Brandon-Jones: John [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Davies: Thomas Elwyn [Passed five years' course at the Liverpool School of Architecture, University of Liverpool. Exempted from Final Examination], Birkenhead.

Evans: John Edward [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Fung: Tsun [Special Final Examination], Hong Kong.

Gibb: Miss Florence Helen [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Hodgson: John Ernest, B.A.Arch. [Passed five years' course at the Bartlett School of Architecture, University of London. Exempted from Final Examination].

Kendall: Welbury [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Knowles: James Metcalfe [Final], Halifax.

Lewis: Edward Reginald, A.A.Dip [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Low: Miss Margaret [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Marsh: Philip Rene, A.A.Dip. [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Messenger: Robert Michael Veitch [Passed five years' course at the Architectural Association. Exempted from Final Examination], Herne Bay.

Napper: Jack Hollingworth [Passed five years' course at the School of Architecture, Victoria University, Manchester. Exempted from Final Examination], Hull.

Owen: Miss Patricia Joan, A.A.Dip. [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Parker: Eric William, Dip.Arch.(Leeds) [Passed five years' course at the School of Architecture, Leeds College of Art. Exempted from Final Examination], Leeds.

Seymer: Major Vivian Home, D.S.O., M.C. [Passed five years' course at the Architectural Association. Exempted from Final Examination].

Swan: Sheriton Clements, B.A., A.A.Dip. [Passed five years' course at the Architectural Association. Exempted from Final Examination], Stocksfield.

Worrow: John Pearson [Passed five years' course at the Architectural Association. Exempted from Final Examination].

R.I.B.A. PROBATIONERS.

During the month of December 1935 the following were enrolled as Probationers of the Royal Institute :—

Alexander: William, 1 Monnery Road, Highgate, N.19.
Arschavir: Ara Leo, 35 Moorland Road, Didsbury, Manchester.
Bell: Guy Norman, 123 St. George's Square, S.W.1.
Bowler: Frederick Charles, 38 Henley Road, Leicester.
Brickell: Stanley Victor, The Bungalow, Ivy Cross, Shaftesbury, Dorset.
Coia: John Peter, 88 Drumover Drive, Glasgow, E.1.
Elliott: John Edward, 20 Great Marlborough Street, London, W.1.
Entwistle: Frederick Douglas, 339 Marine Road Central, Morecambe, Lancs.
Foy: Wilfred Wishart, 17 Woodside Road, Bickley, Kent.
Hall: John Buchan, "Eldersyde," Galashiels, Scotland.
Hawkins: Francis Fred, 34 Beswick Avenue, Ensbury Park, Bournemouth.
Hindle: Ian Macfarlane, 12 Melling Road, Southport, Lancs.
Jeffcoat: Stanley, 6 King's Road, Fiarfield, Buxton.
Karanjgaokar: Dattatraya Gangadhar, 14 Chandra Terrace, Kandewadi, Bombay, 4, India.
Kendall: (Miss) Irene Margaret, 20 Harbour View Road, Parkstone, Dorset.
Knight: Victor Clarence Henry, "Burnton," Hare Lane, Claygate, Surrey.
Kothari: Narendra Kuvergi, c/o Messrs. Master, Sathe and Bhuta, 41 Haman St. Fort, Bombay, India.
Legerton: Colin Arthur, 92, Bellemoor Road, Southampton.
Lewin: Frederick Alexander, 3 Quarry Gardens, Tonbridge, Kent.
MacDonald: Thomas, 2 Viewforth Gardens, Edinburgh.
Myall: George Ernest Henry, 25 Church Road, Southend-on-Sea, Essex.
Nicol: Arthur Wyllie, 9 Tavistock Place, London, W.C.1.
Northridge: Ivor James, "Dunoon," 7 Carlton Road, Derby.
Osman: Louis, 1 Gordon Street, Gordon Square, London, W.C.1.
Robertson: Peter McDonald, "Bayville," Dysart Road, Kirkcaldy, Fife.
Samuel: David Tudor Kenneth, "Harlech," Borough Road, Loughor, Swansea, Glam.
Shackleton: Norman, 75 Nelson Street, Carlisle, Cumberland.
Shimmin: Frederick Henry, Langdale Villas, Castlegate, Pickering, Yorks.
Stacey: Fred Vickers, 43 Gisborne Road, Sheffield, 11.
Stewart: William Stanley, 34 Waverley Crescent, Lemington, Northumberland.
Swan: James John, 38 Forbes Road, Edinburgh.
Thompson: Eric Hamilton, 27, Clyde Street, Salford, 7, Lancs.
Warner: Robert Watkin, Windrush Vicarage, Oxford.
Warwick: Ian Francis, 38 East Dulwich Grove, S.E.22.
Webb: Charles Cecil George, 12 Sefton Street, Timaru, New Zealand.
Whelan: Randolph Saint George, 16 Upper Clanbrassi Street, Dublin.
White: Leslie Simley, 180 Warminster Road, Woodseats, Sheffield, 8.
Whiteman: Alec, "Croftgates," Hollyfast Road, Coventry.
Woollatt: James Gordon, 6 Newcastle Avenue, Beeston, Notts.
Wright: Edward Stephen, 19 Stockwell Park Crescent, S.W.9.

Notices

THE FIFTH GENERAL MEETING, MONDAY, 27 JANUARY 1936, AT 8.30 P.M.

The Fifth General Meeting of the Session 1935-36 will be held on Monday, 27 January 1936, at 8.30 p.m., for the following purposes :—

To read the Minutes of the Fourth General Meeting to be held on 13 January 1936.

To present the Medals and Prizes, 1936.

The President, Mr. Percy E. Thomas, O.B.E., to deliver his Address to Architectural Students.

Evening dress optional.

EXHIBITION OF PRIZE DRAWINGS

The Annual Exhibition of Designs and Drawings submitted for the Prizes and Studentships, 1936, will remain open at the R.I.B.A. until 29 January. The Exhibition will be open daily (Sundays excepted) free to the public between the hours of 10 a.m. and 8 p.m., Saturdays 10 a.m. and 5 p.m.

THE NEXT "SOCIAL EVENING" AND THE "EXHIBITION OF EVERYDAY THINGS"

The next social evening, announced in the R.I.B.A. *Kalendar* to take place on Monday, 10 February, 1936, has been postponed until Monday, 2 March 1936. The evening will take the form of a soirée, which will be opened at 8.30 p.m. by a short talk by Mr. R. A. Duncan [*A.*] on the Exhibition of Everyday Things, followed by light refreshments and a view of the Exhibition.

Members are invited to bring guests.

Further particulars will be announced in the next issue of the JOURNAL.

INFORMAL GENERAL MEETING

WEDNESDAY, 12 FEBRUARY 1936

The Third Informal General Meeting will be held on Wednesday, 12 February 1936, at 6.15 p.m., when there will be an open discussion on "The Architect and the Development of Building Technique."

The chairman will be Miss Justin Blanco-White.

Full particulars regarding the speakers will be published in the next issue of the JOURNAL.

Tea will be served from 5.30 p.m.

R.I.B.A. ANNUAL DINNER 1936

The Annual Dinner will take place on Monday, 3 February 1936, at 7 for 7.30 p.m., in the R.I.B.A. Henry Florence Hall, 66 Portland Place, W.1. Full particulars were contained in the circular letter to members enclosed with the issue of the JOURNAL for 7 December 1935.

R.I.B.A. ANNUAL RECEPTION

The Council have decided to hold a Reception at the R.I.B.A. on Wednesday, 20 May 1936, from 9 p.m. to 12 p.m. Further details will be published in due course.

BRITISH ARCHITECTS' CONFERENCE, SOUTHAMPTON, 24-27 JUNE 1936

The Annual Conference of the Royal Institute of British Architects and of its Allied and Associated Societies will take place at Southampton from 24 to 27 June 1936.

The Hampshire and Isle of Wight Architectural Association have in hand the preparation of a most attractive programme and particulars will be issued in due course.

LICENTIATES AND THE FELLOWSHIP

The attention of Licentiates is called to the provisions of Section IV, Clause 4 (*b*) and (*cii*), of the Supplemental Charter of 1925. Licentiates who are eligible and desirous of transferring to the Fellowship can obtain full particulars on application to the Secretary R.I.B.A., stating the clause under which they propose to apply for nomination.

THE NATIONAL ASSOCIATION OF WATER USERS

Members are reminded that the National Association of Water Users, on which the R.I.B.A. is represented, exists for the purpose of protecting the interests of consumers.

Members who experience difficulties with water companies, etc., in connection with fittings are recommended to seek the advice of the Association. The address of the Association is 46 Cannon Street, London, E.C.4.

OVERSEAS APPOINTMENTS

When members are contemplating applying for appointments overseas they are recommended to communicate with the Secretary R.I.B.A., who will supply them with any available information respecting conditions of employment, cost of living, climatic conditions, etc.

Competitions

The Council and Competitions Committee wish to remind members and members of Allied Societies that it is their duty to refuse to take part in competitions unless the conditions are in conformity with the R.I.B.A. Regulations for the Conduct of Architectural Competitions and have been approved by the Institute.

While, in the case of small limited private competitions, modifications of the R.I.B.A. Regulations may be approved, it is the duty of members who are asked to take part in a limited competition to notify the Secretary of the R.I.B.A. immediately, submitting particulars of the competition. This requirement now forms part of the Code of Professional Practice in which it is ruled that a formal invitation to two or more architects to prepare designs in competition for the same project is deemed a limited competition.

CARDIFF: NEW GENERAL HOSPITAL

The Glamorgan County Council are proposing to hold a competition for a new General Hospital, and Mr. E. Stanley Hall [*F.*] has been appointed to act as Assessor. No conditions are available yet.

DUNDEE: COLLEGE OF ART

The Dundee Institute of Art and Technology are to hold a competition for the Duncan of Jordanstone College of Art. Conditions are not yet available.

EDMONTON: NEW TOWN HALL BUILDINGS

The Edmonton Urban District Council are proposing to hold a competition for new Town Hall Buildings, and Mr. E. Berry Webber [*A.*] has been appointed to act as Assessor. No conditions are available yet.

HARPENDEN: NEW PUBLIC HALL

The Harpenden Urban District Council invite architects of British nationality and domiciled in the United Kingdom to submit in competition designs for a new Public Hall.

Assessor: Mr. Robert Lowry [*F.*].
Premiums: £100, £75 and £50.
Last day for receiving designs: 1 March 1936.
Last day for questions: 31 December 1935.

LUTON: NEW SECONDARY SCHOOL

The Bedfordshire County Council are proposing to hold an open competition for a new Secondary School for Boys at Luton, and Professor W. G. Newton [*F.*] has been appointed to act as Assessor. No conditions are available yet.

NEWCASTLE-UNDER-LYME: BLOCK OF SHOPS AND OFFICES

The Borough of Newcastle-under-Lyme are proposing to hold a competition for a new Block of Shops and Offices, and Mr. H. S. Fairhurst [*F.*], of Manchester, has been appointed to act as Assessor. No conditions are available yet.

SALISBURY, SOUTHERN RHODESIA: NEW PARLIAMENT HOUSE

The Government of the Colony of Southern Rhodesia invite architects of British citizenship to submit, in competition, designs for a new Parliament House to be erected at Salisbury, Southern Rhodesia.

Assessor: Mr. James R. Adamson [*F.*].
Premiums: £500, £300, £200 and £100.
Last day for receiving designs: 31 January 1936.
Last day for questions: 26 August 1935.

SOUTHPORT: NEW CIVIC BUILDINGS

The Southport Town Council invite architects of British nationality to submit, in competition, designs for new civic buildings, comprising police headquarters, fire station, courts, etc., on the "Woodlands" site.

Assessor: Mr. E. Vincent Harris, O.B.E. [*F.*].

Premiums: £300, £200 and £100.

The last day for receiving designs has been extended to 31 March 1936.

Last day for questions: 1 January 1936.

Conditions of the competition may be obtained on application to Mr. R. Edgar Perrins, Town Clerk, Town Hall, Southport. Deposit £1 1s.

NORTH BRITISH ARCHITECTURAL STUDENTS' ASSOCIATION COMPETITIONS

The North British Architectural Students' Association invite members (i.e., members of Schools and/or Allied Societies at Manchester, Glasgow, Edinburgh, Leeds, Sheffield, Hull and Newcastle) to submit, in competition, designs for:

1. A Church of England Chapel.
   Assessor: Mr. H. L. Hicks [*F.*].
   Prize: 10 guineas, presented by London Brick Co. and Forders, Ltd.
2. A Control Tower and Waiting Room for an Aerodrome.
   Assessor: Mr. R. Bradbury [*A.*].
   Prize: 10 guineas, presented by The Cement Marketing Co., Ltd.

Last day for receiving designs: 31 January 1936.

Conditions may be obtained on application to the Hon. General Secretary, N.B.A.S.A., School of Architecture, Armstrong College, Newcastle-upon-Tyne, 2.

COMPETITION FOR JOINT RAILWAY RECEIVING OFFICES IN LONDON

The four main railway companies (L.N.E.R., L.M.S., G.W.R. and Southern) are proposing to hold a competition for a design for Standard Joint Railway Receiving Offices in London, and the following have been appointed to act as Assessors: Mr. L. H. Bucknell [*F.*], Mr. C. Grasemann, Mr. W. H. Hamlyn [*F.*], Mr. Charles Holden [*F.*], Vice-President, R.I.B.A. No conditions are available yet.

COMPETITION RESULTS

COATBRIDGE: PUBLIC BATHS AND PUBLIC HEALTH OFFICES.

1. Messrs James Davidson and Son [*L.*] (Coatbridge).
2. Messrs. Walker, Hardy [*A.*] and Smith [*A.*] (Glasgow).
3. Mr. James Miller, R.S.A. [*F.*] (Glasgow).

DUBLIN: NEW GOVERNMENT OFFICES

1. Mr. J. R. Boyd-Barrett [*A.*] (Dublin).
2. Messrs. A. E. Jones and S. S. Kelly (Dublin).
3. Miss E. G. Butler in association with Professor R. M. Butler [*F.*] (Dublin).

FALKIRK: NEW MUNICIPAL BUILDINGS

1. Messrs. J. Inch Morrison [*F.*] and W. Carruthers Laidlaw (Edinburgh).
2. Messrs. James MacGregor [*A.*] and J. L. Gleave [*A.*] (Edinburgh).
3. Messrs. Mervyn Noad [*A.*] and A. F. Wallace [*A.*] (Glasgow).

PORTSMOUTH: DEVELOPMENT OF LUMPS FORT SITE

1. Messrs. Wesley Dougill [*A.*] and E. A. Ferriby (Liverpool).
2. Mr. Gilbert H. Jenkins [*F.*] (London).
3. Messrs. Reginald Poole and Richard H. Kelly [*A.*] (Liverpool).
4. Mr. S. Cameron Kirby [*F.*] (London).

Members' Column

Owing to limitation of space, notices in this column are restricted to changes of address, partnerships vacant or wanted, practices for sale or wanted, office accommodation, and appointments vacant. Members are reminded that a column in the Advertisement Section of the Journal is reserved for the advertisements of members seeking appointments in architects' offices. No charge is made for such insertions and the privilege is confined to members who are definitely unemployed.

NEW PARTNERSHIP

Mr. Edwin Gunn [*A.*], having concluded a partnership with Mr. A. Falconar Fry [*A.*], the style of the firm will in future be Gunn & Fry. The address of the practice will be 27 The Avenue, Minehead, Somerset.

PARTNERSHIP WANTED

F.R.I.B.A., with wide experience of over 20 years' practice abroad, is desirous of settling in England, and securing a share of a practice. Member, who is at present in England, could meet architect interested, with photographs of buildings designed by him, costing up to £250,000. Capital, say £2,000, available.—Box No. 7136, c/o Secretary R.I.B.A.

PRACTICE FOR SALE

Well-established busy West Country Practice for Sale for health reasons. Premium £1,000. Several works planned and about to start.—Box No. 1136, c/o Secretary R.I.B.A.

CHANGES OF ADDRESS

Mr. J. B. F. Cowper [*F.*] has removed from 53 Gower Street, W.C.1, and has opened new offices at 38 Bedford Square, W.C.1. The telephone number will be the same—Museum 6660.

Mr. D. E. Harrington [*A.*] is now architect to the Capital Advisory Trust, Ltd., Cross Keys House, Moorgate, E.C.2. Telephone: Metropolitan 1516. This is now his address for business purposes.

Mr. John P. Blake [*A.*] has changed his address from Bank House, High Street, Hounslow, to 24A Bath Road, Hounslow, London, W. Mr. Blake will be glad to receive catalogues, etc., at his new address.

On and after 13 January 1936 Mr. R. T. Westendarp [*A.*] will have as his address High Holborn House, 52-54 High Holborn, W.C.1. Telephone: Holborn 2942.

Owing to the restoration work in Staple Inn, Mr. J. O. B. Hitch [*A.*] is temporarily removing to Furnival House, 14-18 High Holborn, W.C.1, as from 6 January 1936. Telephone number unchanged.

Minutes IV

SESSION 1935-1936.

At the Fourth General Meeting of the Session 1935-1936, held on Monday, 13 January 1936, at 8 p.m.

Mr. Percy E. Thomas, O.B.E., President, in the Chair.

The Meeting was attended by about 290 members and guests.

The Minutes of the Third General Meeting, held on 2 December 1935, having been published in the Journal, were taken as read, confirmed and signed as correct.

The Hon. Secretary announced the decease of:

Edward Mitchel Gibbs, M.A. (Hon.), J.P., elected Fellow 1892. Mr. Gibbs was a Past President of the Sheffield, South Yorkshire and District Society of Architects and Surveyors.

Charles William Harris, elected Associate 1896, Fellow 1915.

William Hunter McNab, elected Fellow 1906.

Leonard Martin, elected Fellow 1902.

Charles Samuel Thomas, transferred to Fellowship 1925. Mr. Thomas was a Past President of the South Wales Institute of Architects and represented that body on the R.I.B.A. Council from 1927 to 1929.

Charles Henry Bourne Quennell, elected Fellow 1908, transferred to Retired Fellowship 1935. Mr. Quennell was a member of the R.I.B.A. Council from 1912 to 1915, the Board of Architectural Education from 1928 to 1930, and the Town Planning and Housing Committee from 1914 to 1925.

Robert Charles Hamilton Hinton, elected Associate 1930.

Edward Unwin, elected Associate 1925. Mr. Unwin was a member of the Practice Standing Committee from 1929 to 1934, a member of the Town Planning and Housing Committee since 1931, and a member of the Slum Clearance Committee since its formation in 1932.

Alexander Shepherd Brodie, elected Licentiate 1930.
Philip Ernest Brown, elected Licentiate 1911.
William Hastings Crofts, elected Licentiate 1910.
George Herbert Rawcliffe, elected Licentiate 1911.

And it was Resolved that the regrets of the Institute for their loss be entered on the Minutes, and that a message of sympathy and condolence be conveyed to their relatives.

The following members attending for the first time since their election were formally admitted by the President :

Fellows :

Norman Jewson	Michael Tapper

Associates :

W. B. Attenbrow	H. A. P. Kent
G. W. Banfield	W. J. Pierre-Hunt
Dennis C. Earle	John Simms
S. Everson	William G. Sinning
James E. Flatman	K. R. Smith
John L. Hope	E. F. Stacy
C. J. Jerram	H. T. Townsend
L. Klay Kaines	Denis Winston

Licentiates :

Arthur C. Day	P. W. Haine
	J. Lovelock

Students :

Miss B. M. Beatty	O. D. G. Manning
Oswald Brakspear	Ian D. F. Pickin
F. W. Cousins	H. F. Robinson
J. H. Daniell	Miss Aylmer Rowntree
R. M. de Guérin	Miss Pamela Slater
W. G. Maddison	R. J. Smyth

The President announced that the Council proposed to submit to His Majesty the King the name of Mr. Charles Henry Holden [*F.*] as a fit recipient of the Royal Gold Medal for 1936.

The Secretary having read the Deed of Award of Prizes and Studentships made by the Council under the Common Seal, the sealed envelopes bearing the mottoes of the successful competitors were opened and the names disclosed.

The Hon. Humphrey A. Pakington [*F.*], President of the Architectural Association, read his review of the works submitted for the Prizes and Studentships, 1936, and illustrated it by lantern slides.

On the motion of Mr. Ernest Gillick, A.R.A., seconded by Mr. J. Rhodes, Secretary to the Secondary Schools Examination Council of the Board of Education, a vote of thanks was passed to Mr. Pakington by acclamation and was briefly responded to.

The proceedings closed at 9.50 p.m.

Architects' and Surveyors' Approved Society

ARCHITECTS' ASSISTANTS' INSURANCE FOR THE NATIONAL HEALTH AND PENSIONS ACTS

Architects' Assistants are advised to apply for the prospectus of the Architects' and Surveyors' Approved Society, which may be obtained from the Secretary of the Society, 26 Buckingham Gate, London, S.W.1.

The Society deals with questions of insurability for the National Health and Pensions Acts (for England) under which, in general, those employed at remuneration not exceeding £250 per annum are compulsorily insurable.

In addition to the usual sickness, disablement, and maternity benefits, the Society makes grants towards the cost of dental or optical treatment (including provision of spectacles).

No membership fee is payable beyond the normal Health and Pensions Insurance contribution.

The R.I.B.A. has representatives on the Committee of Management, and insured Assistants joining the Society can rely on prompt and sympathetic settlement of claims.

A.B.S. Insurance Department

PENSION AND FAMILY PROVISION SCHEME FOR ARCHITECTS

This scheme has been formulated by the Insurance Committee of the Architects' Benevolent Society and is available to all members of the R.I.B.A. and its Allied and Associated Societies.

The benefits under the scheme include :—

(1) A Member's Pension, which may be effected for units of £50 per annum, payable monthly and commencing on attainment of the anniversary of entry nearest to age 65. This pension is guaranteed over a minimum period of five years and payable thereafter for the remainder of life.

(2) The Beneficiary's Pension, payable as from the anniversary mentioned in Benefit No. 1, but to the widow (or other nominated beneficiary) if the member dies before age 65. The amount of this pension is adjusted in accordance with the disparity between the ages of the member and his wife.

(3) Family Provision. Under this benefit a payment of £50 yearly is made to the dependent from the date of death of the member prior to age 65 until attainment of the anniversary previously mentioned, after which benefit No. 2 becomes available.

Provision can be made for any number of units (of £50 per annum) up to a maximum of £500 per annum.

Pension benefit only may be secured if desired and the pension commuted for a cash sum.

Members are entitled to claim rebate of Income Tax on their periodical contributions to the scheme both in respect of pension and of family provision benefit.

Full particulars of the scheme will be sent on application to the Secretary, A.B.S. Insurance Department, 66 Portland Place, W.1.

It is desired to point out that the opinions of writers of articles and letters which appear in the R.I.B.A. JOURNAL must be taken as the individual opinions of their authors and not as representative expressions of the Institute.

Members sending remittances by postal order for subscriptions or Institute publications are warned of the necessity of complying with Post Office Regulations with regard to this method of payment. Postal orders should be made payable to the Secretary R.I.B.A., and crossed.

R.I.B.A. JOURNAL

DATES OF PUBLICATION.—1936.—8, 22 February; 7, 21 March; 4, 25 April; 9, 23 May; 6, 27 June; 18 July; 8 August; 5 September; 17 October.

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